TAMING TECHNOLOGY

QUESTIONS AND SOLUTIONS BY THE AUTHORS AND EDITORS OF WHOLE EARTH REVIEW

EDITED BY J. BALDWIN WITH HOWARD RHEINGOLD

PROPOSAL

Taming Technology: Questions and Solutions by the Authors and Editors of Whole Earth Review

Edited by J. Baldwin, [with/and] Howard Rheingold

Draft: 10/26/92

Why this book? Why these authors?

Technology is the most important issue in the world right now. Weapons of mass destruction are technology issues. Environmental deterioration and depletion of resources are technology issues. Energy use and petroleum politics are technology issues, and so are electronic freedom and privacy questions. The least visible parts of technologies — the social and power structures that technologies make possible — have led to the most suffering through misapplication of technology. The invisible parts of technology, what Langdon Winner calls "regimes," often are the most important and least understood parts of technological systems. But as citizens and societies, we haven't found a way to make sensible decisions about technology. *Our biggest problem with technology is the lack of a way for our society to understand, discuss, and decide upon technological issues.*

A technology-dependent world culture already exists. Technologies of the future threaten to raise the stakes even higher. Which means that now is best time to identify the control points in the system, before the system evolves beyond human control.

Taming Technology addresses the urgent need to elevate and broaden the level of debate about technology. What little debate has occurred about the effects of technology has been confined to academic ghettos or polarized between neo-Luddites and unreconstructed technocrats. Technology saves lives. Technology kills people. Both are true. What can we do about learning to discriminate? For a long time, aggressive pro-technology propaganda and genuine popular enthusiasm have failed to acknowledge the side effects and complexities of high-technology civilization. Anti-technology intellectuals and neo-Luddites have been prophetic, but have failed to offer recommendations for technological governance. The average citizen is rightly confused, uneasy, and left impotent in setting technology policy.

We need a new view of technology, seen as a vast, co-evolving complex system that includes both human technologies and the natural world, with benefits and liabilities tangled together. We need a new mental model and a new vocabulary to discuss it. And we need a way to think about solutions.

Whole Earth has always presented solutions along with the questions, and *Taming Technology* includes both deep criticism of technology and proposed paths to solutions. For years, *CoEvolution Quarterly* and *Whole Earth Review* articles about technology and technology policy have been read, circulated, and quoted by policy-makers and their advisers. Because it is not influenced by advertisers or political bias, *Whole Earth Review* has a uniquely balanced view that people have come to trust. We take pride in our record of technological prophecy, and our long practice of questioning our fundamental premises.

At the same time, Whole Earth publications have provided resources for the development of benign, appropriate, sustainable technologies. And we have long championed the belief that providing tools for citizens who think for themselves and take effective action, is an important way to get important things done.

The Book

The form of the book is a collection of ideas that form a toolkit for thinking about technology, from a varied ensemble of Whole Earth authors and others. The core of *Taming Technology* consists of the essays, introductions, and reviews published in *Whole Earth Review* issue #73 ("Questioning Technology") and *CoEvolution Quarterly* #36 ("When Things Go Wrong"). A few important pieces by Ivan Illich, Stewart Brand, Wendell Berry, J. Baldwin, Howard Rheingold and others from other previous issues, from the *Ecolog*, and from *Soft Tech* will be added.

Editors J. Baldwin and Howard Rheingold have wide experience in technology, and are involved in extensive networks of individuals and organizations interested in improving the interface between technology, society and the environment.

The remaining material will be commissioned and collected from these sources specifically for this volume. The new material will expand both the scope and the authorship to include women in technology writing about women and technology, and Third World authors writing about technology issues in the Third World. Military, intelligence, and business

technologies will be addressed, with an emphasis on those who are trying to find solutions. Emerging issues and potential solutions in future technologies such as nanotechnology, industrial ecology, artificial life, genetic engineering and virtual reality will be included.

New ways of thinking are important and necessary, but not sufficient. We don't stop with showcasing new ideas, but search out new kinds of action. As always, we find the people who are *doing* something about problems, and give them a voice. Theoretical flights are juxtaposed with practical proposals such as Amory Lovins' "feebates" scheme for replacing gas-guzzlers on the highways with more fuel-efficient cars; or Buckminster Fuller's famous 1946 Dymaxion House, an elegant, energy- and materials-efficient home designed to be produced inexpensively in factories that formerly made military equipment (J Baldwin is currently working on a restoration of this house. His report will be a scoop.); or proposals by Mitch Kapor and others for a universally-accessible public computer network that embraces common-carrier principles, protects fundamental citizen rights, and provides a level playing field for competition and a platform for innovation. WER authors and editors provide provocative questions, possible answers, and access to the tools you need to make up your own mind and help mobilize opinion about technology policy.

The glue that holds the parts together consists of introductions (to the whole book, the separate sections, and the individual selections) by the editors. J. Baldwin will be the chief editor of the book and Howard Rheingold will provide new introductions, reviews, and essays in addition to those in WER #73.

Outline

(Items marked with * have been published in previous WER/CQ/WEC Issues)

Introduction:

The introduction explains us, the book, and the traditional Whole Earth publication position: We have no axes to grind, we are beholden to nobody, and we have followed the co-evolution of human civilization, the biosphere, and technological culture for the past 25 years. We aim to present a spectrum of viewpoints, not simply technological enthusiasm or anti-technology screeds. We put intellectual and political tools into people's hands, but do not advocate any single ideological blueprint for using those tools. We intend to raise the level of dialogue about technology and to create the bases for new visions of technology development.

Part One: Contrasting Views of Technology Philosophy

Introduction to Part One

Buckminster Fuller: "Critical Path"*

Ivan Illich: "Beauty and the Junkyard"*

[INSERT: Earlier WER articles]

Lewis Mumford: "Authoritarian and Democratic Technics"

[INSERT: See also early WEC

Langdon Winner: "Artifact/Idedas and Political Culture"*

Jacques Ellul: [INSERT: Need to make a selection]

Jerry Mander: "In The Absence of the Sacred"*

William Barrett: "The Illusion of Technique"

Witold Rybznsky: [INSERT: From earlier issue]

R. Crumb Illustrations

Reviews

Part Two: Technology History

Introduction to Part Two

Gideon: "Technics and Civilization"*

Howard Rheingold: "Tools for Thought"

Morris Berman: "The Reenchantment of the World"

Reviews

Part Three: Technology Issues

Introduction to Part Three

Technology and Politics

Wendy Alter and James S. Logan: "NASA Goes to Ground"*

Amory B. Lovins and Hunter L. Lovins: "Winning the Peace"*

Technology and Society

J Baldwin: "Designer As Savior, Designer as Slave."*

Gary T. Marx: "Privacy and Technology."*

Elin Whitney-Smith: "Information Doesn't Want"*

Technology and the Developing World (Appropriate Technology)

Jason Clay: "Genes, Genius, and Genocide"*

Russell Means: "Fighting Words on the Future of the Earth"

Technology and Women

Elin Whitney-Smith: "Figure and Ground"*

Joan Howe: "Housebound"*

Dolores Hayden: "Redesigning the American Dream"

Assessing Technology

Linda Garcia: "Assessing the Impacts of Technology"*

Howard Levine: "Renegotiating Science's Contract"*

Hunter and Amory Lovins: "Brittle Power"

Ithiel de la Sola Pool: "Forecasting the Telephone"

Peter Schwartz: "The Art of the Long View"

Eric Drexler: "Engines of Creation"

Reviews

Part Four: Technology and the Future

Introduction to Part Four

Neil Postman: "Technopoly"

Peter Calthorpe: "The Post-Suburban Metropolis"*

Patricia Glass Shuman: "Reclaiming our Technological Future"

Howard Rheingold: "The Dark Side of Virtual Reality"

Steven Levy: "A-Life Nightmare"*

Simson Garfinkel: "Transgenic Plants"*

Langdon Winner: "Mythinformation"*

Jean Baudrillard: "Simulations"

Eric Drexler: "Unbounding the Future"

Reviews

Part Five: Examples of Well-Managed Technology

Introduction to Part Five

J. Baldwin: "Designer as Savior, Designer as Slave"*

J. Baldwin: "Stuff that Works"

Amory Lovins: [PICK SOMETHING]

J. Baldwin: "Fuller's Dymaxion House"

Reviews

Conclusion: Taming Technology

Faith without works is dead. Complaints and critiques without practical solutions are not useful at this point in history. We intend to draw conclusions about how people can deal with the technological issues. Drawing on the material presented in the book, we show that citizens and government institutions need to establish standards, worldwide agreements about the regulation of technology as the first step toward a global technological ethic that takes into account he ultimate welfare of the Earth

and its citizens. The problems of technology must be seen as systemic problems; we suggest ways in which the "bugs" in the system (e.g., greed, aggression, ignorance of downstream consequences) can be taken into account in formulating a code of ethics for technological development. "Regulation will never equal understanding and respect."

Production Details

There are two main scenarios for producing a book of about 200 pages. In an 8" X 10 1/2" format, the same as *Whole Earth Review*, with retention of original design elements, costs could be reduced. Or a publisher could buy only the contents, provided by the editors, and the publisher would provide design and production. In either case, permission fees and a reasonable share of royalties need to be arranged and paid to authors, in addition to paying the editors. Deadlines also vary according to these scenarios.

About the Editors and Authors

Howard Rheingold is the author of *Virtual Reality* (Summit, 1991), *Tools for Thought: The People and Ideas Behind the Next Computer Revolution* (Simon and Schuster, 1985), *Excursions to the Far Side of the Mind* (Morrow, 1988), and *They Have a Word For It: A Lighthearted Lexicon of Untranslatable Words and Phrases* (Tarcher, 1988). His books are published in UK, Japan, Germany, France, Italy, and Sweden.

He is coauthor of *Talking Tech: A Conversational Guide To Science And Technology* (Morrow, 1983), *Higher Creativity: Liberating the Unconscious for Breakthrough Insights* (Tarcher, 1984), *New Technology Coloring Book* (Bantam, 1983), *The Cognitive Connection: Thought and Language in Man and Machine* (Prentice Hall, 1987), and *Exploring the World of Lucid Dreaming* (Ballantine, 1990).

Rheingold is the author of *New Tools for Thought: Communication Systems for an Information Age*, a report to the United States Congressional Office of Technology Assessment, and is a member of the OTA panel on communication systems.

Rheingold has published articles about science, technology, computers, software, language, and psychology in *The New York Times, Psychology Today, Esquire, Playboy, The San Francisco Examiner, Whole Earth Review, PC,* and *PC-World.* He has served as an editor, writer, and consultant to Apple Computer, the Bank of America, Xerox Corporation, Lawrence Berkeley Laboratories, SRI International, Activision Software, Pacific Telesis, Pacific Bell, Broderbund Software, Arthur Andersen, Zoetrope, Paramount, and Columbia studios. He is editor of *Whole Earth Review*, multimedia columnist for *Publish*, and contributing editor to *Asahi Pasocon* (Japan).

He has lectured about virtual reality and virtual communities in New York, Tokyo, Paris, London, Edinburgh, Oxford, Augsberg, Cophenagen, Groningen, and has appeared on ABC's "Prime Time Live," NBC's "Today," and "CBS Evening News" shows, talking about virtual reality.

Education: National Merit Scholar, 1964-68; B.S., Reed College, 1968

J. Baldwin

Current Work:

(1991) Automotive consultant to Global Business Network.

Editor-in chief, *Whole Earth Ecolog* (Harmony-Crown 1990)

Technology and Nomadics editor, *Whole Earth Review* (nee *CoEvolution Quarterly*), as I have been for 18 years. A book is in progress.

Instructor, Department of Environmental Studies and Planning, California State University at Sonoma.

Assistant Land Steward, California Academy of Sciences' 3000-acre Pepperwood nature preserve (which is where I live).

Working with Amory Lovins on Soviet Georgia/US high-school student exchange solar camp project (currently on hold).

Working with a team under Amory Lovins developing a radical eco-car.

Director of Buckminster Fuller Institute's Wichita House restoration project.

Consultant and speaker for Ecotech Conference (Nov. 91).

I have a design studio/prototype shop where I develop ideas into usable form. The shop deploys from a converted 2 1/2-ton bread truck that can travel to the worksite as required. It tows a photovoltaically powered Airstream trailer that has housed me in a wide variety of locations for 13 years. Current projects include a stair-climbing wheelchair, a folding commuter bicycle, and a transparent geodesic ("Garden 0f Eden") dome greenhouse/home.

Past Work

Recent articles published in *Annals of Earth Stewardship, Outside, ID (Industrial Design), Automobile, Harrowsmith, Country Journal, Trimtab (the Buckminster Fuller Institute Newsletter) and Alaska Airlines magazine.*

(1989) Editor, issue 62 of *Whole Earth Review*.

(1988) Co-editor, the CD-ROM version of the *Essential Whole Earth Catalog* (Broderbund/Apple), an early demonstration of Hypercard technology.

(1987) Editor, issue 55 of *Whole Earth Review*.

(1986) Editor-in-chief, of the *Essential Whole Earth Catalog* (Doubleday) 75,000 in print.

(1983-1985) Adjunct faculty, World College West, Novato, CA. Also land steward for the college's new rural campus while it was under construction.

(1979-1982) Member/researcher, New Alchemy Institute, Cape Cod. Work included wind-powered refrigeration and water pumps, bioshelters, aquaculture, editing various institute publications, and giving lectures on institute research. Principal work was the development and construction of the geodesic "Pillowdome," a 750-square-foot solar greenhouse skinned with triple-layer triangular Tefzel pillows inflated with argon. The dome weighs about one-half pound per square foot of floor area, yet it has withstood hurricane wind gusts of up to 130 miles per hour as well as heavy snow loads. It operates 100% solar year round with no fossil-fuel backup. Sponsors included DuPont and the National Endowment for the Arts. Buckminster Fuller cut the ribbon. As far as I know, it remains the lightest insulated, transparent, leakproof, permanent structure yet devised.

(1982) Tour leader for an appropriate technology tour of The People's Republic of China. We were the first Westerners in recent times to visit many rural areas.

(1982) Visited (by 110-foot wooden sailboat) assorted islands in French Polynesia and the Cook Islands, assessing energy needs.

(1981) Consultant to Ocean Arks International, Cape Cod.

(1981) Consultant to the (Canadian) Threshold Foundation, Seychelle Islands, assisting islanders with pond aquaculture, solar crop driers and water heaters. (With Stewart Hill and John Todd.)

(1978) Project evaluator, California State Small Energy Grants program.

(1978) Energy consultant, Tetiaroa Island, for Marlon Brando (with Stewart Brand); Wind energy consultant, Point Reyes Bird Observatory, Bolinas, CA.

(1978) Edited *Soft Tech*, the first roundup of critical essays and reviews of alternative energy books and hardware (33,000 sold).

(1977-1979) Consultant, builder and sometime actor for The New Western Energy Show division of AERO, Billings, MT, a travelling alternative-energy road show and exhibit.

(1975-1977) Faculty, Environmental Studies department, California State University at Sacramento. Land steward, Odyssey Orchards, Winters, CA.

(1974-1975) Lecturer in Wind Energy Technology, University of California, Davis, Experimental College.

(1973-1974) Researcher and builder (under Robert Reines), Integrated Life Systems Laboratory (ILS), Tijeras, NM. We designed and built a home and machine shop, complete with pickup truck, totally run by solar energy in a notably hostile environment. There I successfully demonstrated Buckminster Fuller's nonmechanical "chilling machine" air-conditioning effect by maintaining an uninsulated sheetmetal building's interior temperature at 85 degrees F while ambient outside temperature exceeded 100 degrees F.

(1970-1972) Cofounded Mother Lode Raft Trips, one of the first clients-paddle river outfitters. (It became California's largest.)

(1969-1971) Faculty/builder, Pacific High School (Los Gatos, CA), the oldest and possibly most infamous Summerhill-type alternative high school. Worked with unusual kids to design and build their own geodesic dormitories.

(1970) Worked on *Domebook One* and *Domebook Two* production crew.

(1969-1970) Invented and built the first Pillowdomes, including one for Buckminster Fuller. Designed and built several other geodesic domes of various types. All worked well (and didn't leak).

(1962-1969) Taught art, design and communications full-time and part-time at California State University at San Francisco, California College of

Arts and Crafts, San Francisco Art Institute, and Southern Illinios University freshman through graduate level. One of my students, Charles Hall, invented the waterbed as his master's-thesis project in my graduate design seminar.

Other student work directed by me included sets for American Conservatory Theater, Berkeley Repertory Theater, and a solar light show in a geodesic theater for the 1966 Magic Mountain Festival (50,000 attended). I also participated in a program that trained black dropouts to build seventeen day-care centers in their neighborhoods. A team of my students designed and built a portable central-business-district kid's playground intended to occupy downtown building sites until construction started. It lasted for 12 moves. (Funded by Bobby Kennedy.) With student apprentices, I designed and built a 918-mm F/4 (that's big) telescope from military-surplus parts. Acted as Peace Corps student advisor.

(1958-1962) Apprenticed to Bill Moss, master tent designer. We did tents, tension structures, toys, and the first US camper-van conversion (for Ford). Developed an air-droppable field hospital for U.S. Army Quartermaster Corps. Our work appeared at NYMMA and the Smithsonian. While there, I personally developed an all-aluminum catamaran sailboat and several cardboard boats and shelters. I also worked as a professional potter, specializing in large (200-lb.) hand-thrown bowls.

Education

1955 B.S. Industrial Design (Vehicle concentration), University of Michigan, Ann Arbor. Major work included a working gas turbine car, a 750 cc H modified class sportscar, and a folding 40 foot diameter geodesic sphere for a Buckminster Fuller seminar. Bought the eighth VW Beetle to be imported. Member APX, Architecture fraternity.

1964 Worked for M Architecture, University of California, Berkeley under Charles Moore and Joe Esherick. The 1964 "Free Speech" uprising and a divorce interrupted me and I never went back. (Other things beckoned.)

I have taken (and still take) many single courses in subjects that interest me, such as prospecting geology, MIDI electronic music technique, and computer use (MAC).

PART ONE:

CONTRASTING VIEWS OF TECHNOLOGY PHILOSOPHY

Beauty & The Junkyard

BY IVAN ILLICH

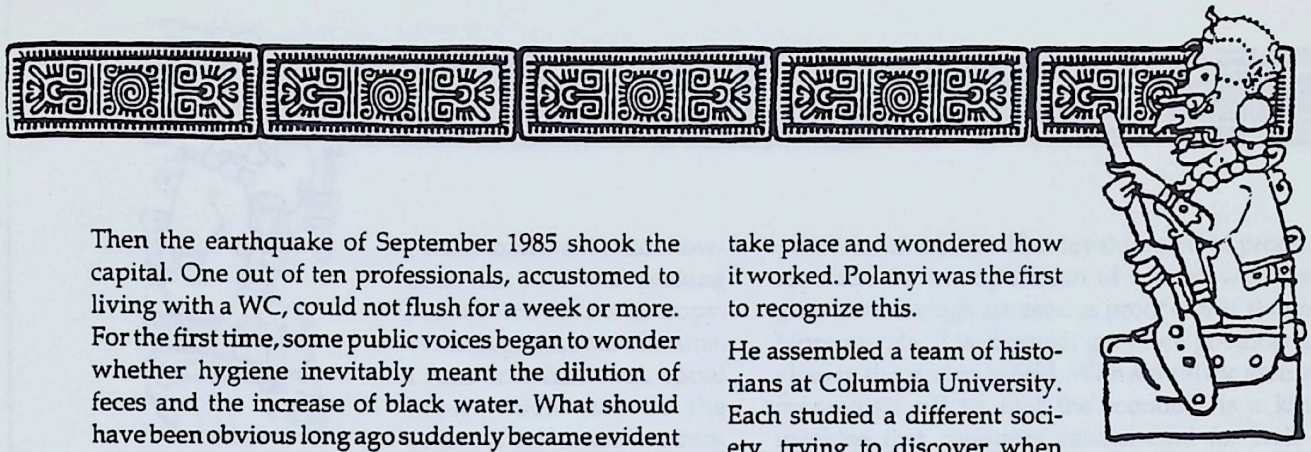
MEXICO CITY PRESENTS THE WORLD with a new, modern plague. Salmonella and amoebas are now routinely transmitted through the respiratory tracts of people living there. When I arrive at the high valley of Tenochtitlán (8,000 feet above sea level), surrounded by mountains, I struggle to breathe the thin air, the atmosphere heavily polluted by an especially high-particle-density smog.

In four decades the city grew from one million to over twenty million people. The one experience shared by most newcomers before their arrival was nearly unlimited open space. Today, between four and five million people lack any special place to deposit their daily stool, urine and blood. And the general population of the city does not possess toilet habits appropriate to a densely populated habitat, habits which immigrants to Calcutta or Cairo bring with them to the city. Mexican concepts of cleanliness have never been shaped by the constraining ideal of Hindu, Muslim or Confucian disciplines.

Further, Mexican leadership remains singularly blind to the matter. The Western prejudice against bowel movements unless one sits over water with paper at hand is endemic among the Mexican elite. Mentally, middle-class Mexicans live in a complex nation where a temporary economic crisis has cut the flow of dollars and water. The illusion of living in a crisis, and the habit of flushing a toilet, pushed the body waste of more than four million of their other neighbors out of sight for most professionals.

Ivan Illich asks questions that shake the ground most of us think we stand on. His historical investigation of the commons, and of the self-reliant communities that evolve from it, cast our technological society — based on scarcity — in a new light.

Illich's collaborative "Declaration on Soil" appeared in our Summer 1991 issue. Versions of "Beauty & The Junkyard" have appeared in England, in Fourth World Review *and* The Guardian. *It will be included in Illich's next book,* In the Mirror of the Past, *a collection of his lectures over the last decade or so, to be published by Marion Boyars (New York) and distributed by Rizzoli International (New York).*
—Richard Nilsen



Then the earthquake of September 1985 shook the capital. One out of ten professionals, accustomed to living with a WC, could not flush for a week or more. For the first time, some public voices began to wonder whether hygiene inevitably meant the dilution of feces and the increase of black water. What should have been obvious long ago suddenly became evident to a few: to provide water for millions of toilets is beyond the economic power of Mexico, whatever timespan was set. And even if there were enough money and a more rational use of flush technology, the attempt to pump sufficient water to operate the city's toilets would destroy the semi-arid agriculture practiced within a radius of several hundred miles. Further, the amalgamation of potentially fertile feces with barely degradable waste — characteristic of modern sewer systems — would poison rather than enrich the fragile topsoil built up over centuries in the plots surrounding the city at lower altitudes.

A small but potentially influential number of people saw their image of the city broken by the earthquake. It still has not touched the smugness of the country's officialdom, but it did shake people who are able to look at their hitherto-unexamined certainties about the nature of waste and the very character of the megalopolis as the producer of economic value.

In many parts of the world today, cities are seen as sources of wealth and rural areas as the retreat of a privileged few, but, on the whole, as an economic "problem." The rural economy of the United States may be the best current example. But where does urban wealth come from? Every schoolboy can answer: the economy. Fine. But what *is* the economy?

I was helped in my understanding of this question by my reading of Karl Polanyi. He was instructed by Aristotle. The *Politics* had been read by Greek, Arabic, and Latin scholars for over two thousand years. The great modern European commentaries had long been written. But no interpreter had taken Aristotle at his word. They seemed to believe that he was either sneering at merchants or joking about them, speaking with tongue in cheek.

Aristotle observed something new and unheard-of in Athens. Some citizen merchants were using a previously unknown technique when they offered their goods in the market. Instead of selling these goods at cost plus profit, or keeping to the values established by treaty with a foreign supplier, these innovators let the price vary according to offer and demand. Aristotle was fascinated that such a transaction could take place and wondered how it worked. Polanyi was the first to recognize this.

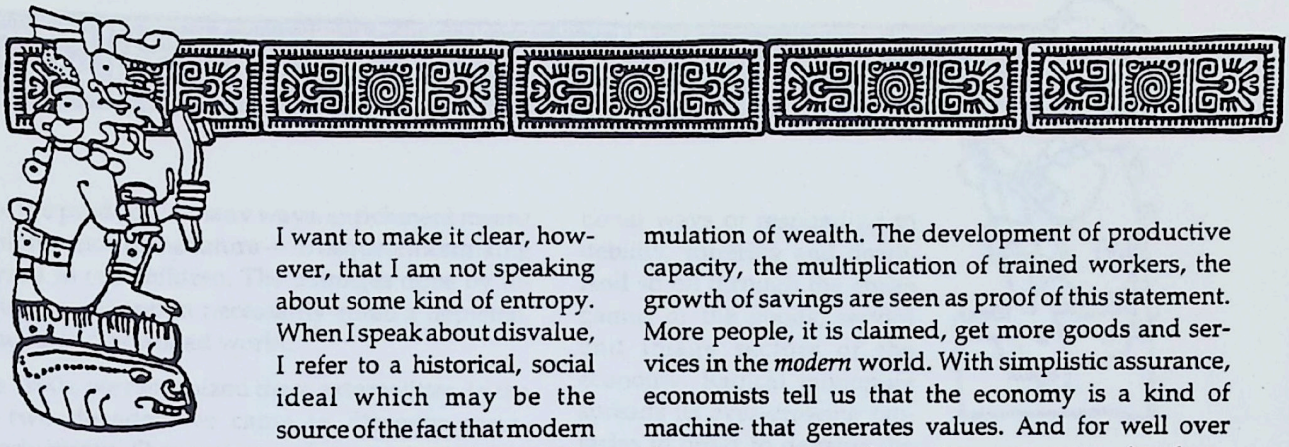
He assembled a team of historians at Columbia University. Each studied a different society, trying to discover when prices first began to move according to supply and demand in ordinary times. All of them reported the same finding. The replacement of simple trade by this marketing technique, though practiced occasionally while being generally legally proscribed, was not part of the ordinary social life in any ancient society. Further, such an arrangement only became the form of common behavior at the time of Aristotle and after.

Here I began to see the first lineaments of what is today called the economy — a system resting on scarcity.

History of Disvalue

No wonder Aristotle was surprised. Up to this historical moment, the management of the goods necessary for everyday life in the city was nowhere structured in terms of scarcity. In fact, societies were generally so arranged that the experience of scarcity could not emerge.

Back, then, to our question. Wealth is believed to come from the economy. But I have come to suspect that the primary product of the economy is waste. To understand both this statement and the situation of Mexico City, I suggest the use of the term "disvalue." What we need, precisely, is a *history* of disvalue. I choose this concept in order to emphasize its direct relation to economics. But it means something quite other than price, cost or economic loss. I strongly suspect that the social creation of disvalue is the necessary condition for the recognition and acceptance of, and desire for, mass products as valuable. Disvalue is necessarily related to a certain kind of economics because it makes such an economics possible. Modern economics presupposes the devaluation of culturally determined patterns of behavior. The mass production of goods, services, and images demands cultural blight through the spread of disvalue throughout the society. The necessary matrix for the accumulation of economic value, the very character of a successful modern society, is the principled devaluation of traditional cultures.



I want to make it clear, however, that I am not speaking about some kind of entropy. When I speak about disvalue, I refer to a historical, social ideal which may be the source of the fact that modern society has transformed the Earth from an open, breathing space into a stinking junkyard.

Disvalue is not just a modern term for an age-old perception variously named as evil, the devil, guilt, or exploitation. What I talk about is new — the social program of degrading the cultural patterns through which people have traditionally found joy and meaning in the name of a reified ideal called development. By disvalue I mean something historical. The concept of disvalue provides me with a tool to study the break between economics under the conditions of a commons and under the conditions of scarcity management.

Waste is something more and other than an unwanted side effect of the economy, a kind of social analog to entropy. Waste is a disvalue, the condition that makes modern forms of production possible. It has a history that cries out for study. Such a history would reveal that waste is not a natural consequence of all cultural action. It is false to assume that all cultures had some kind of concept of waste, and that some were more successful than others in its management.

The expansion of economic relations into ever more aspects of everyday life does not produce values; rather, it concentrates privilege.

The history of disvalue appears the moment one discovers value. But this fact is completely obscured if one approaches economic history as a story of progress. Progress conventionally means the accumulation of wealth. The development of productive capacity, the multiplication of trained workers, the growth of savings are seen as proof of this statement. More people, it is claimed, get more goods and services in the *modern* world. With simplistic assurance, economists tell us that the economy is a kind of machine that generates values. And for well over three generations, this naive assumption has been shared in a vulgar way by most people.

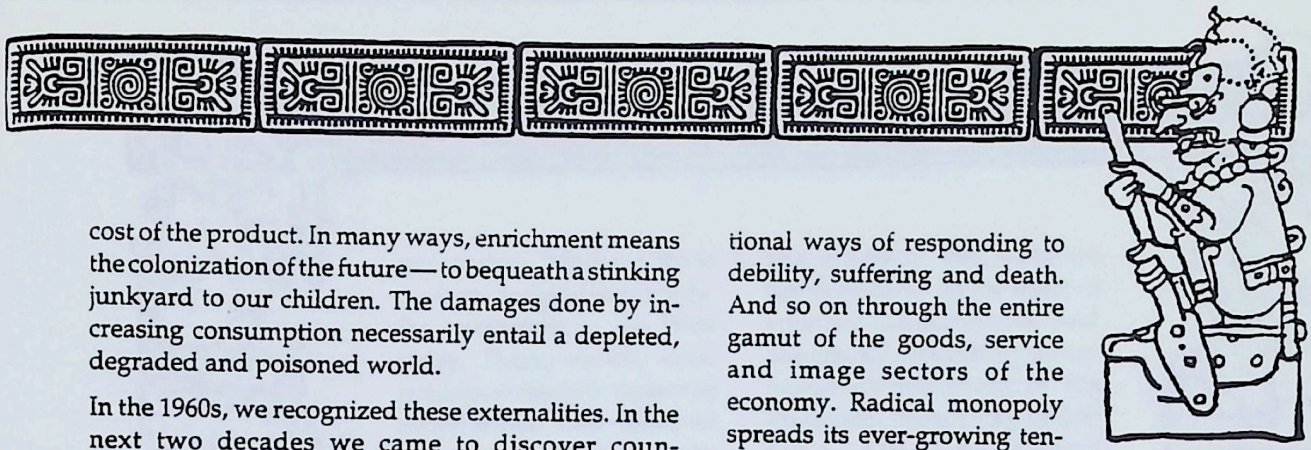
Concentration of Privilege

Now it begins to sound hollow. People suspect that the expansion of economic relations into ever more aspects of everyday life does not in fact produce values but, rather, concentrates privilege. And this privilege, which only a higher income can buy, is principally an escape from the disvalue that more and more affects the lives of all. Increasingly, disvalues appear as the principal output of the economy, and the production of goods and services as the means to prevent being injured by these disvalues.

Until quite recently, the cultural changes that come with enrichment were seen as a necessary condition for human wellbeing. Needs seemed to arise. The economy transformed them into demands for commodities. And so the motor for more and more production was kept running. Some began to see that most people then came to depend on something historically new — commodities were a special type of good. And, by social definition, they were scarce. Human beings came to be seen as needy, and society was a collection of needy people. Now we see that these cultural changes are a devaluation of self-sufficiency. Greater demand really means that people are more needy. Slowly, we begin to see that the progressive devaluation of culture, the environment and the human person is the driving force of economic production.

We no longer identify economic growth with improvement in the human condition. Disvalues loom larger than the highly advertised benefits of the industrial age. First, the unwanted side effects of production came to be recognized as externalities. We have learned something about the cost of these externalities, about the social price of many products. And as societies experience greater progress, so more refined heights of privilege are created.

We now see that many unwanted and harmful side effects can be measured, but not internalized in the



cost of the product. In many ways, enrichment means the colonization of the future — to bequeath a stinking junkyard to our children. The damages done by increasing consumption necessarily entail a depleted, degraded and poisoned world.

In the 1960s, we recognized these externalities. In the next two decades we came to discover counterproductivity. Our major modern institutions, in their very character, exercise a paradoxical power: they prevent most of their clients from reaching the very goals for which they were originally designed and financed. In the sixties, this observation was taken as a joke. In the nineties, it is sheepishly and quietly taken for granted. Schools cannot but degrade more people than they enfranchise; health care cannot but create a more terrifying range of suffering and despair; the acceleration of transportation cannot but make movement ever more time-consuming for the great majority.

How to explain these phenomena? How to understand these costs? How to accept the public's acquiescence? We can begin to answer these questions by bringing to light a new underlying principle that our major institutions and their accompanying legal framework have assumed. They now operate with a new kind of monopoly — what I call radical monopoly.

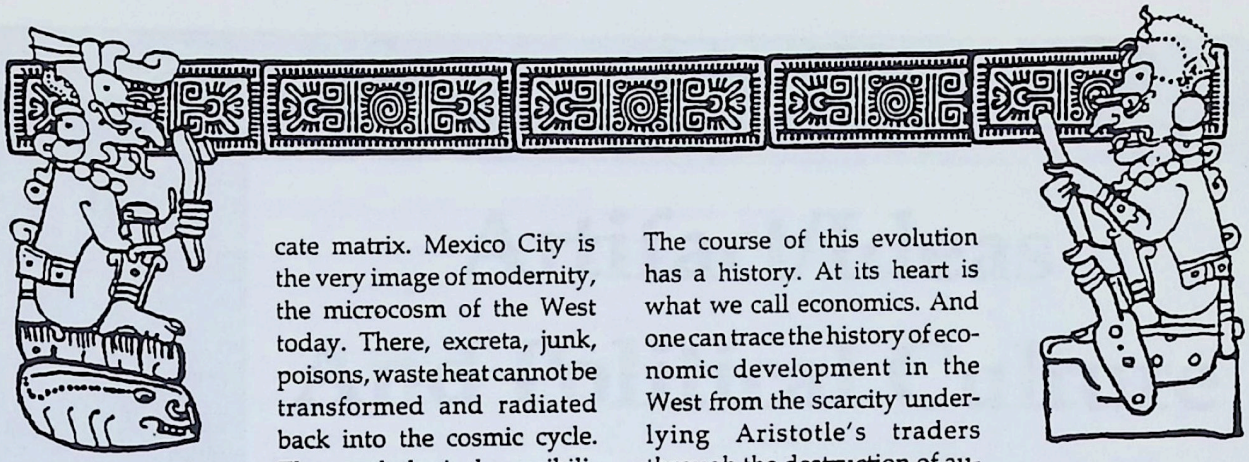
Earth Wisdom

We usually understand monopoly as a situation where one firm corners the market to the exclusion of all others. Such commercial monopoly is often forbidden by law. In the United States, for example, one carrier cannot take over all the air routes of the country. A second kind of monopoly reaches much deeper. In Southern California, major auto manufacturers bought up public transportation systems in an attempt to promote the private automobile as the only effective means of transit. This is a technological monopoly. At a third level, one can discern something more far-reaching, a radical monopoly. Here, for example, motorized transportation excludes the use of feet. Through such means as propaganda, the imposition of controlling metaphors, the legitimization and sacralization of one institutional response, our major institutions seek to impose this kind of monopoly on society. This is the monopoly of wheels over feet, of schools over other forms of learning, of the magico-technological treatment of sickness over all traditional ways of responding to debility, suffering and death. And so on through the entire gamut of the goods, service and image sectors of the economy. Radical monopoly spreads its ever-growing tentacles in order to devalue the activities for which we do not need modern economic products, commodities. Finally, disvalue becomes a kind of velvet python, squeezing all life out of us. Eliot's hollow men now stalk the Earth, zombie-like creatures, plugged into a grand and sparkling array of technological wonders.

A certain geo-sophical principle, an Earth wisdom, has been violated. Through a continual flow of the water cycle through the atmosphere, the topsoil and human culture, the earth lives in a kind of open system. Now we see that the contribution of culture is decisive for this system's life.

An essential condition for the flourishing and survival of any society is the task of protecting and enhancing the water-soil matrix of the environment. Western society, through the intensification and extension of disvalue, goes in the opposite direction. It grinds toward the inevitable destruction of this deli-

Modern economics presupposes the devaluation of culturally determined patterns of behavior. The mass production of goods, services, and images demands cultural blight through the spread of disvalue throughout the society.



cate matrix. Mexico City is the very image of modernity, the microcosm of the West today. There, excreta, junk, poisons, waste heat cannot be transformed and radiated back into the cosmic cycle. The mythological possibilities of human cultivation are smothered under the stinking blanket of a yellow-gray miasma. The Earth now evolves into a self-centered pile of trash where the accumulation of wastes extinguishes the rhythms of a living and breathing planet.

The course of this evolution has a history. At its heart is what we call economics. And one can trace the history of economic development in the West from the scarcity underlying Aristotle's traders through the destruction of autonomous cultural responses to the human condition, through the transformation of a lovely planet into a stinking junkyard, to the evisceration of the human comedy itself. The study of disvalue opens this puzzling history to our eyes.

The Electronic Sweatshop

For many of us, computers are liberating, creative tools. But, as ***The Electronic Sweatshop*** *amply documents, the dark Satanic mills of the twenty-first century may come with keyboards and cathode-ray tubes.*

Computers can be misused for surveillance and for building privacy-busting dossiers (see "The Rise of the Computer State," WER #44, and "Privacy and Technology," on p. 90 of this issue), for dehumanizing the workplace (See ***Processed World*** *review,* ***Signal*** *p. 193), and, as* ***The Electronic Sweatshop*** *points out, for monitoring worker productivity. Many data-entry companies regularly monitor "keystrokes per hour," a production pressure that increases cases of Repetitive Stress Syndrome. Machines for ensuring machinelike behavior on the part of human workers might be the shadow sides of technologies that extend human perception and augment human intellect.* ***The Electronic Sweatshop*** *is a wonderful, angry polemic that documents a neo-Dickensian subjugation of workers to technology.* —Roger Karraker

[Suggested by Donna Hawley]

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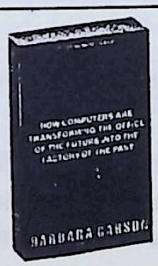
The common telephone dictation systems that link tape machines to typing pools also monitor executives. These systems yield performance records (volume, time and type of work) not only for the typist but for the "dictator." Dictaphone's *Mastermind* and Lanier's *Supervision IV* are two of the many dictation systems with executive monitoring features. Their basic surveillance purpose is indicated by their



The Electronic Sweatshop
Barbara Gerson, 1989; 288 pp.
$9.95 ($11.95 postpaid) from Penguin USA/Cash Sales, 120 Woodbine Street, Bergenfield, NJ 07621; 800/253-6476 (or Whole Earth Access)

names. Tower Systems International advertised the following features of an E-mail monitoring program actually named Surveillance:

- Reporting on all electronic mail messages sent and received
- Reporting on all electronic mail messages sent but not yet opened
- Reporting on all operator sign-on's and sign-off's
- Reporting a list of all attempted security violations, including information on the operator, the location and the time that the attempt took place

Some office doors are now opened by I.D. cards instead of keys. But every time an employee inserts his card to open the outer door, his office door, the supply room or even the bathroom, he also makes a record of the time he came in or went out.

Increasingly, salesmen and executives are asked to put their schedules onto calendar forms in their management information systems. So far the only resistance I've observed is passive. Suddenly, no one can type. If pressed, salesmen keep two calendars, one on the machine and one in their jacket pocket, as routinely as they always kept two expense accounts.

An executive would still be shocked, I think, if his superiors claimed the right to go through his desk and check his appointment book. But riffling through screens seems to be emerging as acceptable business etiquette.

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A U.S. Department of Labor publication estimated that in 1984 nearly two-thirds of the people who worked at video display terminals were monitored by their employers. In less than ten years, electronic surveillance has leaped from the factory into the office in a form that's frighteningly effective. Even Charlie Chaplin's *Modern Times* factory, with its corn-eating machine and its camera in the bathroom, didn't approach total surveillance. In our own "moderner" times, monitoring is not only total but it's fearfully cheap and easy. Once a worker is connected to the keyboard, he times himself.

I don't think we'll ever persuade management to give up electronic monitoring. I think we should outlaw it instead. Or at least ban *individual* monitoring, and restrict electronic monitoring to the collection of aggregate statistics. How we can enforce this ban — who will bell the cat — I can't say. But we can begin by recognizing this increasingly routine bit of programming as a serious invasion of privacy.

Artifact/Ideas And Political Culture

THIS IS A TIME OF GREAT EXCITEMENT about the fruitful possibilities of new technology, but also a time of grave concern about what those possibilities mean for the future of our society. Horizons visible in microelectronics and photonics, biotechnology, composite materials, computing, and other fields hold out prospects of sweeping change in our way of life. How should we regard these prospects?

As individuals, groups and nations anticipate technological change nowadays, they usually focus upon three questions.

First: How will the technology be used? (What are its functions and practical benefits?)

Second: How will the technology change the economy? (What will it contribute to the production, distribution and consumption of material wealth?)

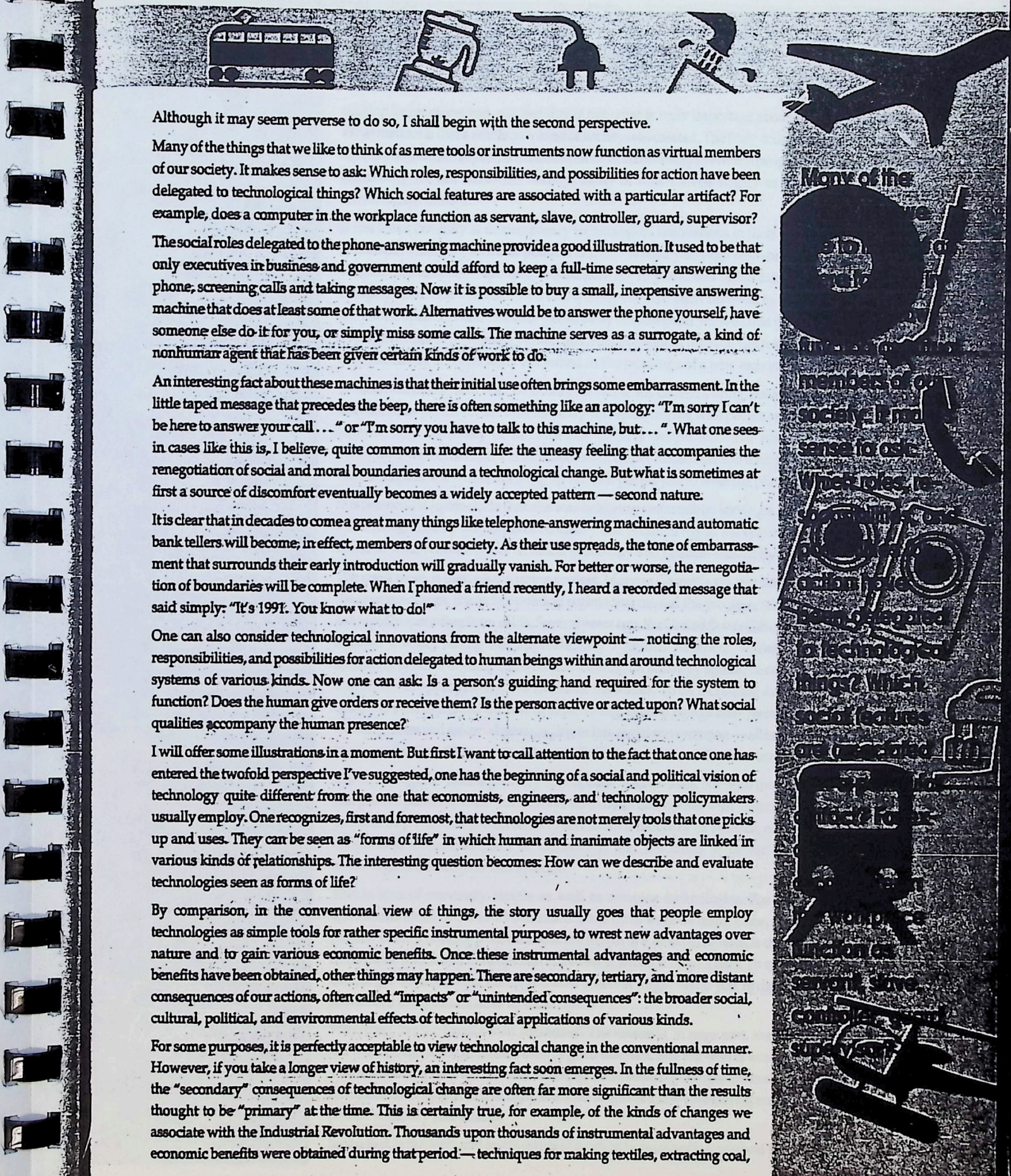
Third: How will the technology affect the environment? (What will be its consequences for global climate change, pollution of the biosphere, and other environmental problems?)

While these are important issues, another crucial question is seldom mentioned: What kind of world are we building here? As we develop new devices, techniques, and technical systems, what qualities of social, moral and political life do we create in the process? Will this be a world friendly to human sociability or not?

These are questions about the relationship of technological change to the evolution of modern political culture. In what ways do the development, adoption, and use of instrumental things affect our shared experience of freedom, power, authority, community and justice? How might we respond creatively to the role technology plays in contemporary political life?

In the titles of a great many books, articles, and conferences these days, the topic is described as "technology and society" or "technology and culture" or "technology and politics." But if one takes a closer look, such distinctions no longer have much validity. In the late twentieth century, technology and society, technology and culture, technology and politics are by no means separate. They are closely woven together in a multiplicity of settings in which many forms of human living are dependent upon and shaped by technological devices and systems of various kinds. Our useful artifacts reflect who we are, what we aspire to be. At the same time, we mirror the technologies that surround us; to an increasing extent, social activities and human consciousness are technically mediated.

In this light, any attempt to understand the matter might well begin from either of two basic starting points: (1) the technological world seen from the point of view of human beings and (2) the same world seen from the point of view of the artifacts.



Although it may seem perverse to do so, I shall begin with the second perspective.

Many of the things that we like to think of as mere tools or instruments now function as virtual members of our society. It makes sense to ask: Which roles, responsibilities, and possibilities for action have been delegated to technological things? Which social features are associated with a particular artifact? For example, does a computer in the workplace function as servant, slave, controller, guard, supervisor?

The social roles delegated to the phone-answering machine provide a good illustration. It used to be that only executives in business and government could afford to keep a full-time secretary answering the phone, screening calls and taking messages. Now it is possible to buy a small, inexpensive answering machine that does at least some of that work. Alternatives would be to answer the phone yourself, have someone else do it for you, or simply miss some calls. The machine serves as a surrogate, a kind of nonhuman agent that has been given certain kinds of work to do.

An interesting fact about these machines is that their initial use often brings some embarrassment. In the little taped message that precedes the beep, there is often something like an apology: "I'm sorry I can't be here to answer your call . . ." or "I'm sorry you have to talk to this machine, but . . .". What one sees in cases like this is, I believe, quite common in modern life: the uneasy feeling that accompanies the renegotiation of social and moral boundaries around a technological change. But what is sometimes at first a source of discomfort eventually becomes a widely accepted pattern — second nature.

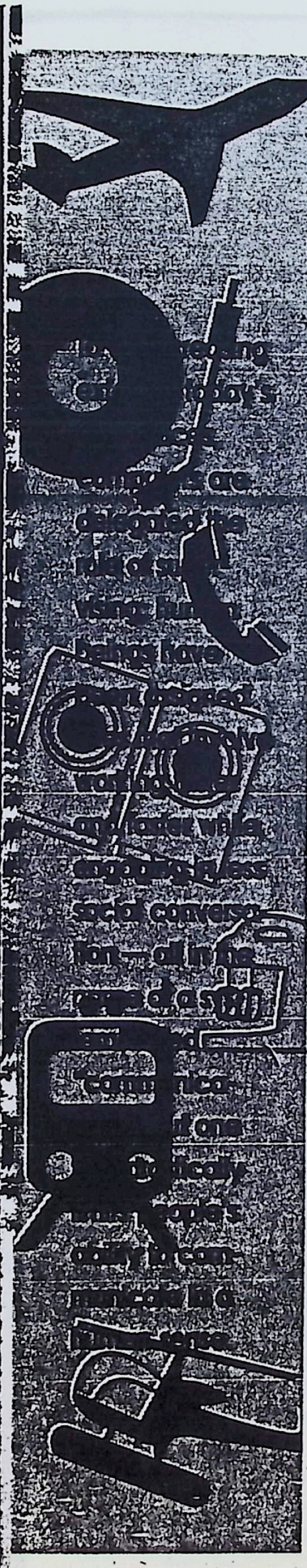
It is clear that in decades to come a great many things like telephone-answering machines and automatic bank tellers will become, in effect, members of our society. As their use spreads, the tone of embarrassment that surrounds their early introduction will gradually vanish. For better or worse, the renegotiation of boundaries will be complete. When I phoned a friend recently, I heard a recorded message that said simply: "It's 1991. You know what to do!"

One can also consider technological innovations from the alternate viewpoint — noticing the roles, responsibilities, and possibilities for action delegated to human beings within and around technological systems of various kinds. Now one can ask: Is a person's guiding hand required for the system to function? Does the human give orders or receive them? Is the person active or acted upon? What social qualities accompany the human presence?

I will offer some illustrations in a moment. But first I want to call attention to the fact that once one has entered the twofold perspective I've suggested, one has the beginning of a social and political vision of technology quite different from the one that economists, engineers, and technology policymakers usually employ. One recognizes, first and foremost, that technologies are not merely tools that one picks up and uses. They can be seen as "forms of life" in which human and inanimate objects are linked in various kinds of relationships. The interesting question becomes: How can we describe and evaluate technologies seen as forms of life?

By comparison, in the conventional view of things, the story usually goes that people employ technologies as simple tools for rather specific instrumental purposes, to wrest new advantages over nature and to gain various economic benefits. Once these instrumental advantages and economic benefits have been obtained, other things may happen. There are secondary, tertiary, and more distant consequences of our actions, often called "impacts" or "unintended consequences": the broader social, cultural, political, and environmental effects of technological applications of various kinds.

For some purposes, it is perfectly acceptable to view technological change in the conventional manner. However, if you take a longer view of history, an interesting fact soon emerges. In the fullness of time, the "secondary" consequences of technological change are often far more significant than the results thought to be "primary" at the time. This is certainly true, for example, of the kinds of changes we associate with the Industrial Revolution. Thousands upon thousands of instrumental advantages and economic benefits were obtained during that period — techniques for making textiles, extracting coal,



making locomotives run, etc. But that is not what is truly important about the Industrial Revolution. What matters is that a whole new kind of society was created. The truly enduring part of that revolution, the truly significant aspect, is the multiplicity of relationships between people and between humans and technology we call Industrial Society, many of which arose largely as secondary consequences of technological change.

If one looks carefully at contemporary technological innovations in their broader human context, one often finds emerging forms of political culture. Several years ago Maevon Garrett, a woman who had worked as a telephone operator in Baltimore for 18 years, was called into her supervisor's office and abruptly fired. She was informed that a computer had been installed to monitor the performance of telephone operators and that data gathered by the computer showed that she was less efficient than the average worker in processing phone calls. At that moment Maevon Garrett became the victim of norms of productivity and efficiency embodied in the workings of a new technological system.

What is interesting, however, is not only the fact of Ms. Garrett's firing, but her response to it. She pointed out that some portion of her time each day was spent talking with people who dial a telephone operator because they are lonely or in distress — elderly people who live alone, or "latchkey children," youngsters who come home after school to an empty house because their parents are still at work. Ms. Garrett argued she would not hang up on such people just to meet the phone company's hourly quota.

It is reasonable to conclude that she was behaving responsibly: serving a role in civic culture, but not a role recognized by the norms of efficiency and productivity in the system that employed her. This is a case in which conditions of technical rationality and cultural rationality meet in flagrant conflict.

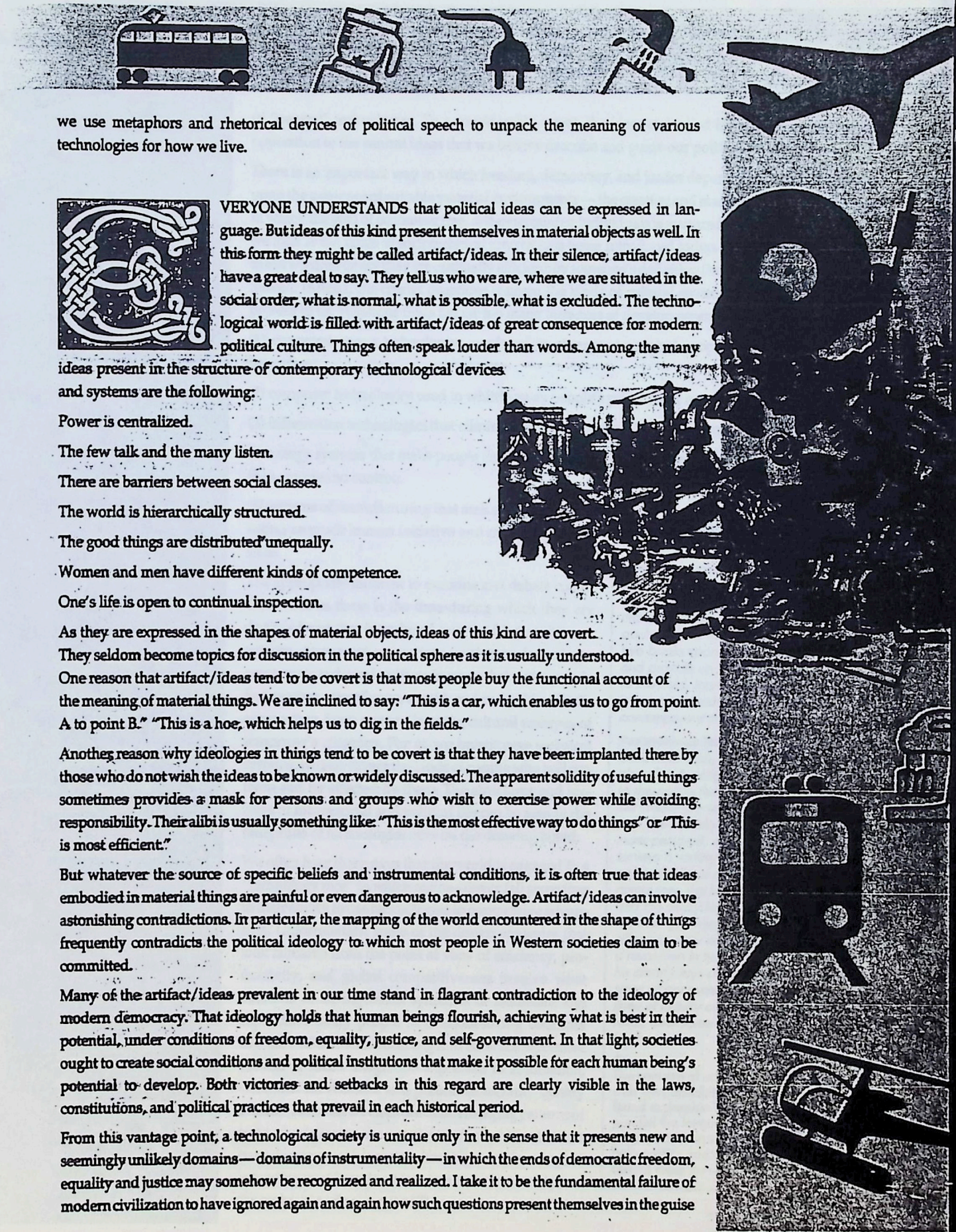
The good news is that, after a union protest, Maevon Garrett's job was restored. The bad news is that the systems design, the technopolitical regime that caused the problem, still exists and looms before us as a rapidly spreading form of life. Several years ago, the United States Office of Technology Assessment released a study noting that approximately 7 million American workers now live under rapidly spreading systems of computerized surveillance, an unhappy spinoff of office automation. The title of that report is, appropriately, *The Electronic Supervisor*. To an increasing extent in today's workplaces, computers are delegated the role of supervising; human beings have been assigned roles that involve working faster and faster while engaging in less social conversation — all in the name of a system called "communications," but one that drastically limits people's ability to communicate in a human sense.

The term "regime" seems perfectly appropriate in such cases. For once they have been designed, built and put in operation, sociotechnical systems comprise regimes with features that can be described in a political way. It makes perfect sense to talk about freedom or its absence, equality or inequality, justice or injustice, authoritarianism or democracy, and the kinds of power relationships contained in technological instruments and systems.

This is true of extremely simple as well as complex technologies. For example, if one visits the agricultural fields of the southwestern US, one finds workers using a hoe, *el cortito*, a tool with a short handle. There's nothing political about the length of a wooden handle, is there? Well, that depends on the broader social relationships and activities in which it plays a part. To use el cortito you must bend over or get down on your knees. A casual observer might say: If you're digging in the ground, isn't it sometimes more comfortable to stand up?

Why, then, has the handle been shortened? The reason is, in large part, that the foremen who manage the work can look across a field, even at great distance, and tell who is working and who is not. Those who are bending over are the ones working; those standing upright are not and the foreman can apply discipline accordingly. In that light, even the length of a hoe's handle expresses a regime — a regime of power, authority and control.

Embodied in the tools and instruments of modern technology is a political world. I am suggesting that



we use metaphors and rhetorical devices of political speech to unpack the meaning of various technologies for how we live.

EVERYONE UNDERSTANDS that political ideas can be expressed in language. But ideas of this kind present themselves in material objects as well. In this form they might be called artifact/ideas. In their silence, artifact/ideas have a great deal to say. They tell us who we are, where we are situated in the social order, what is normal, what is possible, what is excluded. The technological world is filled with artifact/ideas of great consequence for modern political culture. Things often speak louder than words. Among the many ideas present in the structure of contemporary technological devices and systems are the following:

Power is centralized.

The few talk and the many listen.

There are barriers between social classes.

The world is hierarchically structured.

The good things are distributed unequally.

Women and men have different kinds of competence.

One's life is open to continual inspection.

As they are expressed in the shapes of material objects, ideas of this kind are covert. They seldom become topics for discussion in the political sphere as it is usually understood. One reason that artifact/ideas tend to be covert is that most people buy the functional account of the meaning of material things. We are inclined to say: "This is a car, which enables us to go from point A to point B." "This is a hoe, which helps us to dig in the fields."

Another reason why ideologies in things tend to be covert is that they have been implanted there by those who do not wish the ideas to be known or widely discussed. The apparent solidity of useful things sometimes provides a mask for persons and groups who wish to exercise power while avoiding responsibility. Their alibi is usually something like: "This is the most effective way to do things" or "This is most efficient."

But whatever the source of specific beliefs and instrumental conditions, it is often true that ideas embodied in material things are painful or even dangerous to acknowledge. Artifact/ideas can involve astonishing contradictions. In particular, the mapping of the world encountered in the shape of things frequently contradicts the political ideology to which most people in Western societies claim to be committed.

Many of the artifact/ideas prevalent in our time stand in flagrant contradiction to the ideology of modern democracy. That ideology holds that human beings flourish, achieving what is best in their potential, under conditions of freedom, equality, justice, and self-government. In that light, societies ought to create social conditions and political institutions that make it possible for each human being's potential to develop. Both victories and setbacks in this regard are clearly visible in the laws, constitutions, and political practices that prevail in each historical period.

From this vantage point, a technological society is unique only in the sense that it presents new and seemingly unlikely domains—domains of instrumentality—in which the ends of democratic freedom, equality and justice may somehow be recognized and realized. I take it to be the fundamental failure of modern civilization to have ignored again and again how such questions present themselves in the guise

of "neutral" technologies. To a considerable extent, the ideas embodied in material things stand in opposition to the central ideas that we believe describe and guide our political culture.

There is an important way in which freedom, democracy, and justice depend in human communities upon the existence of suitable material environments — the creation and maintenance of arrangements in which the goal of becoming free, self-determining individuals is nurtured rather than destroyed. As we look at the kinds of sociotechnical innovations being introduced today, it is often beside the point to ask whether or not they are optimally efficient; by someone's definition they are usually very efficient indeed. Instead, the crucial questions concern the kinds of cultural environments such technologies present to us. What one finds are far too many instances of developments of the following kind:

(1) communications technologies employed in attempts to control people's thoughts, desires and behaviors;

(2) computer technologies used to whittle away people's privacy and erode freedom;

(3) information technologies that eliminate what were formerly places of community life;

(4) energy systems that make people dependent upon, or even hostage to, sources of fuel over which they exercise no control;

(5) systems of manufacturing that seek control by eliminating as much human initiative and creativity as possible.

The appropriate moment to examine and debate conditions such as these is the time during which they are designed and first introduced into the fabric of human activity. At present our society persists in designing a great many technical artifacts in ways that make people feel passive, superfluous, stupid, and incapable of initiating action. Such systems bear the cultural embryos of tomorrow's citizenry. For as we invent new technical systems, we also invent the kinds of people who will use them and be affected by them. The structures and textures of future social and political life can be seen in the blueprints of technologies now on the drawing board.

We often hear these days that the world is engaged in a "technology race" in which nations rise or fall according to their ability to use technologies to competitive advantage. Unfortunately, some of the design strategies that look fabulous from the point of view of efficiency, productivity, and global competitiveness involve what amounts to an ingenious synthesis of feudalism and capitalism. Many people in freedom-loving countries like the United States seem eager to embrace repressive models of social integration expressed in automation, electronic surveillance and pseudodemocratic "quality circles." But must we embrace these emerging patterns of technofeudalism as the wave of the future? Would it not be a wiser approach to resist, choosing to explore ways of extending our ideas about freedom and a just society into the realm of technology itself?

Langdon Winner is one of the few writers to have tried to make sense out of the mass of writing on technology and its impact on all of us in recent years. These two books span a decade of his work, and provide an illuminating introduction to the field, marked throughout by a willingness to dismiss sloppy thinking and contemporary mythology.

Autonomous Technology *is very much an academic work, a survey of the philosophy of technology with special attention to the notion that somehow the things we create are no longer under our control.* ***The Whale and the Reactor*** *is a more personal, more mature work that surveys a variety of themes including the political side of artifacts, the promise of computers, the hope of decentralization and the shaky legacy of the appropriate-technology movement. Winner does not offer any easy solutions or put his faith in a revolution in human thinking. Instead, he clearly lays out some of the dimensions of our current peril and suggests lines of inquiry and action which, though hard, offer some real hope of leading to change.* —Mike Gunderloy

The concern of science and technology with the possibilities of control have often found expression in terms which closely parallel the language of politics. This is perhaps not surprising if one recalls that both politics and technics have as their central focus the sources and exercise of

One obvious path that may still be open to us is to cultivate ways of democratizing the process of technology policymaking and, indeed, the process of technological innovation. If this is to be done, both citizens and experts will need to become aware of the social, moral, and political dimensions of choices made in technological policy and technological design. They will need to find ways to act directly and democratically within settings in which the important choices are made.

In that light I would offer three guiding maxims as a way to focus discussions about the relationship between technological choices and the future of political culture. These maxims can be raised at times in which unquestioned assumptions about "productivity," "competitiveness," "the need to innovate," or "technology transfer" seem to provide the only language for talking about the choices at hand.

1. *No innovation without representation.* This suggests that all the groups and social interests likely to be affected by a particular kind of technological change ought to be represented at a very early stage in defining what that technology will be. Let us accept the idea that particular technologies are social creations that arise through a complex, multicentered process. But let us see to it that all the relevant parties are included, rather than kept in the dark about this process. If we find that we do not have the kinds of social institutions that make this possible, then let's change our institutions to

Autonomous Technology • The Whale and the Reactor

power. Our thinking about technology, however, seems inextricably bound to a single conception of the manner in which power is used — the style of absolute mastery, the despotic, one-way control of the master over the slave.

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In most modern technological systems autonomous action is truly available to the center alone. Some have argued that peripheral parts also exercise a measure of control by selecting which information actually reaches the center. A few varieties of highly technical organization, think tanks like RAND for example, have found that attempts at central coordination are more of a hindrance than help in getting work done. Taking such paltry signs as a cue, some observers have begun to predict that a collegial decentralization is the wave of the future. But compared to the success of central control in likes of the Apollo program or the worldwide operations of ITT under Harold Geneen, the alleged counterexamples are pathetic.

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In the vogue for "reading dynamics," for example, we see one instance in which the combined emphasis upon speed and efficiency — increased words per minute plus increased comprehension — reduces an activity with many possible values to a pure instrumentality. Slow reading, for example, can often be a marvelous occasion for thoughtful reflection. Nietzsche believed this and advised that readers take a walk to ponder the things that they found insightful in books. But Nietzsche was not Evelyn Wood. He did not know that the primary end of reading is not insight or illumination but merely the maximum information crammed in per minute expended.

—Autonomous Technology

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A crucial failure in modern political thought and political practice has been an inability or unwillingness even to begin the project I am suggesting here: the critical evaluation and control of our society's technical constitution.

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Taken as a whole, beliefs of this kind constitute what I would call mythinformation: the almost religious conviction that a widespread adoption of computers and communications systems along with easy access to electronic information will automatically produce a better world for human living. It is a peculiar form of enthusiasm that characterizes social fashions of the latter decades of the twentieth century. Many people who have grown cynical or discouraged about other aspects of social life are completely enthralled by the supposed redemptive qualities of computers and telecommunications.

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Often held up as a source of illumination on the most difficult questions and choices, the concept of "values" is better seen as a symptom of deep-seated confusion, an inability to think and talk precisely about the most basic questions of human well-being and the future of our planet.

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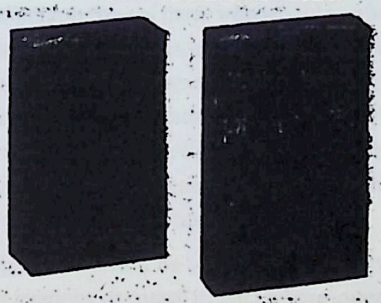
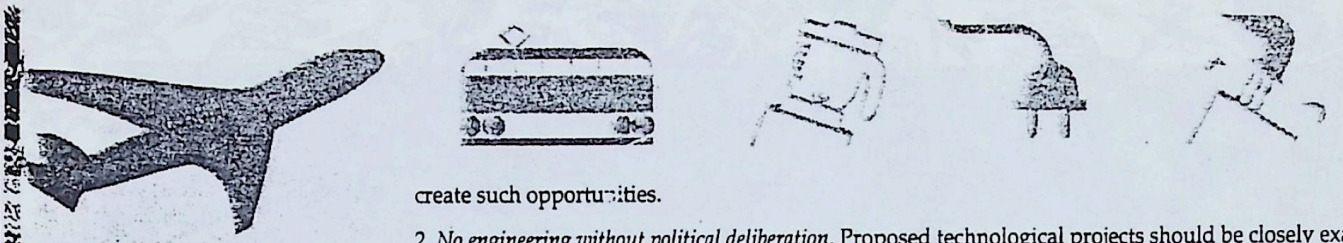
More and more the whole language used to talk about technology and social policy — the language of "risks," "impacts," and "trade-offs" — smacks of betrayal. The excruciating subtleties of measurement and modeling mask embarrassing shortcomings in human judgment. We have become careful with numbers, callous with everything else. Our methodological rigor is becoming spiritual rigor mortis.

—The Whale and the Reactor



Autonomous Technology
Langdon Winner, 1977; 386 pp.
$12.95 ($15.95 postpaid) from The MIT Press, 55 Hayward Street, Cambridge, MA 02142; 800/356-0343 (or Whole Earth Access)

The Whale and the Reactor
Langdon Winner, 1988; 200 pp.
$8.95 ($10.95 postpaid) from The University of Chicago Press, 11030 S. Langley Avenue, Chicago, IL 60628; 800/621-2736 (or Whole Earth Access).



create such opportunities.

2. *No engineering without political deliberation.* Proposed technological projects should be closely examined to reveal the covert political conditions and artifact/ideas their making would entail. This ought to become an interpretive skill of people in all modern societies. It is especially important for engineers and technical professionals whose wonderful creativity is often accompanied by appalling narrowmindedness. The education of engineers ought to prepare them to evaluate the kinds of political contexts, political ideas, political arguments, and political consequences involved in their work. Skill in the arts of democratic citizenship ought to become part of the "tool kit" that engineers master in their education.

3. *No means without ends.* Many of the varieties of innovation pushed on the public these days amount to tools looking for uses, means looking for ends. Those who have dealt with the introduction of computers into the schools in recent years can give many colorful examples of this phenomenon. The current promotion of high-definition television and renewed efforts to push President Reagan's Star Wars project offer even more stark illustration. For HDTV and SDI bear little relationship to any significant human need. As we study the prospects offered by new technologies, it is always essential to ask: Why are we doing this? What are the ends we have chosen and how well do they fit the pattern of means available? In many cases of high-tech planning, suitable background music would be the theme from "Twilight Zone."

If you want examples of places in which principles similar to these three maxims are actually being put to work, I would point to some recent experiments in the Scandinavian democracies, where a positive, creative politics of technology has recently become a focus of research and development. In one such project, workers in the Swedish newspaper industry — printers, typographers, lithographers, and the like — joined with representatives from management and with university computer scientists to design a new system of computerized graphics used in newspaper layout and typesetting. The name of the project was UTOPIA, a Swedish acronym that means "training, technology and products from a skilled worker's perspective."

UTOPIA's goal was to fashion a system that would be highly advanced technically, but designed in ways that would take into account the skills, needs, and perspectives of those who would eventually be using it. Rather than develop a system under management directives and then impose it on workers, the project included representation of the people concerned. UTOPIA became the focus of a rigorous program of research and development at a government-sponsored laboratory, The Center for Working Life in Stockholm. Here was a case in which the purely instrumental and economic thrust of technological innovation encountered a legitimate set of political ends and enlightened artifact/ideas. The result was democratization expressed in hardware, software, and human relationships.

The technological world of the twenty-first century beckons. Will it be better than the one we now inhabit, or worse? Will it realize the promise of human freedom, or curtail it? And whose interests will be decisive?

If ordinary citizens are to be empowered in shaping the world to come, we must become very skillful in areas where we are now profoundly ignorant: using ideas and abilities that enable us to define and realize human freedom and social justice within the realm of technology itself: within things like new machines for the workplace, computerized systems of information management, biotechnologies in agriculture and medicine, communications devices introduced into our homes. If we cannot develop these skills, or do not care to; if we fail to confront the world-shaping powers that new technologies present; then human freedom and dignity could well become obsolete remnants of a bygone era. ❦

Illustration by Tom Tellez

In the Absence of the Sacred

BY JERRY MANDER

THE POSTWAR ERA of the 1940s and 1950s was the period when the American Dream imagery was hyped as never before. Technology was going to make anything and everything possible. With the war over, not even the sky was the limit. A 1949 report by H. G. Moulton, president of The Brookings Institution, argued that the production capacity of the US could support a population of 300 million people at eight times the (1949) standard of living. "There is no known limit," said Moulton, "to the potential wealth of the world."

Ronald Reagan was the radio voice of the General Electric ad campaigns of that era. Years later, when he was president, Reagan employed the same kind of optimistic, expectant rhetoric. Hearing him speak of the wonderful things his Star Wars scheme would achieve, I heard the same style and many of the same words from the commercial imagery of the post-World War II period. In fact, Reagan's success may be explained in part by his connection to that optimistic time; every American who is over forty today grew up with that rhetoric ringing in their ears. It was cheerful, it created positive imagery, and it came at a time when amazing things really did seem possible.

The new value system that was sold in the forties and fifties was designed to fuel the most massive expansion of the US industrial and marketing sectors in history. The "American way of life" became an advertising theme; it drew an explicit equation between how much you consumed and how American you were. During the Truman-Eisenhower years, the American ideal of consumerism was directly juxtaposed with Russia's emphatically non-consumerist stance. In the 1950s, buying a washing machine was a blow against communism.

This value system incorporated certain key attitudes: technological innovation is good. It is always good. It aids health. It saves labor. It is the engine that

In The Absence of the Sacred *changed my mind about technology. I still think there is hope for finding a way to manage technology in the future, despite our failures in the past; but Mander has opened my eyes to the political, economic, and cultural system in which technology is embedded, and which it dominates. I hope it wakes up a lot of other people.*

Although the excerpts here concentrate on Mander's arguments about the misuse of technology in the hands of corporate interests, half of the book is about the people who suffered first and who continue to suffer most from the resource extraction and land grabs that are essential to the continued growth of technology-based consumerism — American Indians and other indigenous people around the world.

Jerry Mander is Senior Fellow at Public Media Center in San Francisco, the world's only nonprofit public-interest advertising agency. He is a council member of Elmwood Institute, an ecological thinktank in Berkeley, CA. And he is the author of Four Arguments for the Elimination of Television *(Quill, 1977).*
—Howard Rheingold

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drives economic growth, which in turn drives the American standard of living upward, which benefits all people. Technical innovation promotes democracy, freedom, and leisure. Technical and scientific progress will spread around the world and relieve all people of the awful toil that has oppressed them since the dawn of time. Someday, every place will look like the World's Fair. It is inevitable. You can't turn back the clock.

For me, going through my teenage years in that period; for my family and neighbors; and, I believe, for most Americans, there was the disposition to go along with it all. Swept along by the rhetoric and hype, it was as though we found ourselves within a gigantic environmental theater.

WE sat and watched while they rolled away one diorama and replaced it with another and then another. While our world was being dramatically transformed, while places we loved were fast deteriorating, while lifestyles were sharply altered, while the forest receded, while open land was paved over and built upon, while pollution and smog became commonplace, while small towns began to look like New York City and New York City began to resemble Fritz Lang's *Metropolis*, we watched as if it were a movie.

To say that we, the public, had no participation in these vast changes would be inaccurate. We lived in the world; we interacted with the changing environment. By our silence we gave our tacit approval. But no one ever inquired into what we thought about it all. No one ever indicated that there could be a question about the process. It all happened so fast, and with so much power, it was difficult to grasp what was changing, as it was changing. The process itself overpowered all doubt. We asked no questions. We never had time to think it through. Even if we'd had the time, we didn't have the thoughts or the words by which to articulate our concerns. There was no language of technological evaluation, nor is there one now. The parameters of the discussion, even the parameters of thought, were predefined by corporate, governmental, and scientific institutions. No formal means existed by which ordinary people could engage in discussions or debates, or could hear the pros and cons of what was happening. There were no national referenda, save for what appeared in the media. And the media reports were mainly confined to advertising or government predictions. If there existed an alternative view, it remained within intellectual circles not visible to the average American.

In the absence of an alternative vision, the paradigm was confirmed that technological innovation was good, invari-

Adbusters Quarterly

*This is surely the only magazine in the world that takes as its central theme the cataclysmic environmental consequences of advertising. Now over $100 billion per year in the US alone, consumer advertising has little function but to encourage people to buy more and more stuff and to universalize material values. One could make the case that advertising is the root cause, or at least the driving mechanism, for the horrific and increasing assault on the world's resources. **Adbusters** makes that case, and does so with impressive scope, detail and joie de vivre.*

*Beyond mere reportage, **Adbusters** is decidedly activist. It has guides to "media wrenching," as well as a series of sharply hilarious media strategies designed to work in tandem with already-prepared videos, to help free people from media and commodity addiction. Another print-and-video campaign, "A Tree Farm Is Not A Forest," offers rainforest trees speaking for themselves. If you can raise the money to place these spots on the air, or the print ads in magazines, **Adbusters** will provide them to you free.* —*Jerry Mander*

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Ten years ago we didn't bother much about the chemicals in our food, or the toxins generated by industry because we believed they were "well within acceptable limits." We were dead wrong about that, and today we may be repeating the same mistake with mental pollution, nonchalantly absorbing massive daily doses of it without a second thought. If we continue to ignore the problem, we may soon find ourselves dealing not only with an irretrievably damaged natural environment, but also with a seriously impaired public mind.

There is an ominous resonance between these two forms of pollution. The holes growing in the ozone layer seem to reflect the great voids growing in our minds. It's frightening to realize how our polluted mental environment both diverts attention from and weakens the resolve required to tackle global crises. Distracted, apathetic citizens make for poor environmental stewards.

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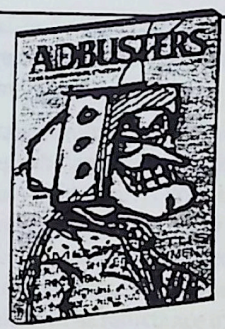
In the United States two-thirds of all doctor-patient visits end with a prescription — an average of seven per year for every American. . . . It is precisely this relationship that drug companies exploit in their advertising to doctors. In Canada last year, they did it to the tune of $33 million in journal advertising alone. Open any of the dozens of medical journals, and you will see that two-thirds of it is full-color advertising imploring doctors to prescribe, to prescribe *their* drug, and to prescribe it now.



Adbusters Quarterly
Kalle Lasn and Cat Simril, Editors.
**$16**/year ($US; 4 issues) from Adbusters Media Foundation, 1243 W. 7th Avenue, Vancouver, BC V6H 1B7, Canada

ably good, and would be the principal means by which our society would solve its problems and produce a better world.

Fifty years later, however, as the world hurtles toward its greatest environmental crisis since the dawn of human life, a crisis driven by the insatiable need to feed resources to the technological machine, and to consume them as commodities, we are at an appropriate moment to question whether this path we have chosen and celebrated has lived up to its promise, and if not, if it ever will.

In the absence of an alternative vision, the paradigm was confirmed that technological innovation was good, invariably good, and would be the principal means by which our society would solve its problems and produce a better world.

LEWIS Mumford said that the "horn of plenty," i.e., the unlimited material goods that technological society promises, qualifies as a "magnificent bribe" meant to get us to overlook what has been lost in the bargain. Isn't it time for a society-wide debate on whether the costs — economic, social, health-related, and environmental — are justified, especially as the benefits (speed, leisure, length of life, commodities) are so marginal and perhaps superficial?

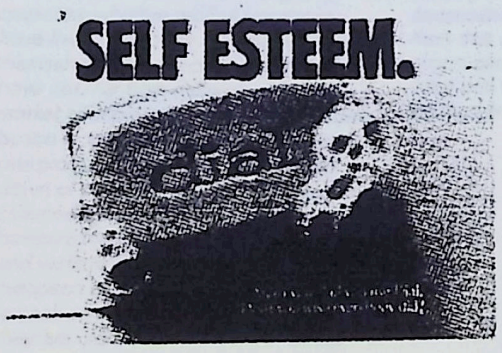
No such debate is taking place, and no such conclusions have been drawn. Bizarre claims as to the alleged benefits of new technologies continue to proliferate. We still hear that new generations of machines will solve the problems left by prior generations of machines. We still hear predictions that a new era of health, comfort, security, leisure, and happiness is just around the corner if only we deepen our commitment to technology.

The operating homilies remain the same: "You can't stop progress." "Once the genie is out of the bottle you cannot put it back." "Technology is here to stay, so we have to find ways to use it better." In reality, these are all rationalizations to cover up a culture-wide passivity; a failure to take a hard look at technology in all of its dimensions, or to draw the obvious conclusions from the evidence at hand.

IN *The Whale and the Reactor*, Langdon Winner calls our current condition "technological somnambulism." He goes on:

> The most interesting puzzle in our times is that we so willingly sleepwalk through the process for reconstituting the conditions of human existence. . . . Why is it that the philosophy of technology has never really gotten under way? Why has a culture so firmly based upon countless sophisticated instruments, techniques, and systems remained so steadfast in its reluctance to examine its own foundations? . . . In the twentieth century it is usually taken for granted that the only reliable sources for improving the human condition stem from new machines, techniques, and chemicals. Even the recurring environmental and social ills that have accompanied technological advancement have rarely dented this faith. . . . We are seldom inclined to examine, discuss, or judge pending innovations. . . . In the technical realm we repeatedly enter into a series of social contracts, the terms of which are revealed only after the signing.

Our passivity to the technological juggernaut has been ongoing for millennia. Some find its roots in agriculture and husbandry. Others cite the emergence of patriarchy. And there is surely a case that the scientific revolution, which



For a commercial to work, the audience must accept two premises: first, that life as it exists is inadequate and inferior; and second, that improvement can be obtained through a purchased product or service.

Think of it. The commercial encourages young viewers to identify those inadequacies in their own lives. What a learning experience for young people still not sure who they are or where they fit in.

articulated a mechanistic view of nature and humanity, altered the prevailing views of life and encouraged fascination with and dependence upon the machine. Whatever the historical roots, we are now embedded in a system of perceptions that make us blind and passive when it comes to technology. I think the following factors are major contributors to the problem:

Dominance Of Best-Case Scenarios

The most obvious problem is the manner in which technology is introduced to us. The first waves of description are invariably optimistic, even utopian. This is because in capitalist societies all early descriptions of new technologies come from their inventors, and the people who stand to gain from their acceptance. Whether in advertisements, public relations presentations, or at landmark events like World's Fairs, the information we are given describes the technologies solely in terms of their best-case use. This is so even when the inventors have significant knowledge of terrible down-side possibilities. It is logical that inventors and corporate and government marketers present only idealized, glamorized versions of technology, since they have no stake in the public being even dimly aware of negative potentials — the worst-case scenarios — though negative results are at least as likely to occur as positive results. Nuclear power is the single exception to this pattern. It has had a somewhat rougher road than other technologies because the public was aware of its worst-case potentials from the moment we first heard about it, at Hiroshima. If we

Because technology is now everywhere apparent, pervasive, and obvious, we lose awareness of its presence. While we walk on pavement, or drive on a freeway, or sit in a shopping mall, we are unaware that we are enveloped by a technological and commercial reality, or that we are moving at technological speed.

The Myth of the Market

In the year of the so-called triumph of capitalism over communism, there is at last one book, published in England, that questions whether market economies have lived up to their advertising about themselves, and concludes that they have not. Far from delivering Utopia, market economics has brought maldistribution of wealth, overuse of resources, overproduction of wastes, the breakdown of planetary support systems, the commoditization of all experience, dehumanization, corporate domination, and welfare dependency. The Eastern European countries might be well advised to seek some third alternative, before they are cloned. —Jerry Mander

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To critics of the markets, its defenders will sooner or later say 'Well what would you put in its place?' This conundrum should more properly be thrown back at the advocates of the system themselves; what are they proposing to put in place of the exhausted earth, the depleted resources, the contaminated water and vitiated air? If it had been the purpose of humanity on earth to bring to the edge of ruin the planet itself, no more efficient mechanism could have been invented than the market system itself, with its prodigious use of energy and materials in the sublime mission of replacing as much of human activity with commodities and the monetary transactions that attend them. The market should play a minimal and functional role in our lives; and to those who ask what should we then do, the answer is: expel the market from all those spaces it has inappropriately invaded, reclaim autonomy and self-reliance wherever this is possible. The market cannot create social justice, it is powerless to distinguish between good and evil; it has no moral role, even less should it be the object of the curious cults that have grown around its mythic power in the West.

Everywhere in the world, alternatives have been suppressed, and continue to be destroyed at an accelerating pace in the face of its invasive power, the most deadly of all colonizations, because it insinuates itself into the spirit and the imagination of people. In its presence, older patterns of self-reliance and non-monetized ways of answering human need are being eliminated. The inferiorizing of traditional customs and patterns of living, the images of 'backwardness', the curse of 'underdevelopment' are part of the same global spectacle — the subordination of the most shining examples of self-reliance to the spread of the Western system. Whatever the benefits of a single global-market, the survival of alternatives will not be one of them. This suggests a level of total control to dwarf all previous tyrannies and totalitarianisms; the dictatorship of the market.

The Myth of the Market
Jeremy Seabrook, 1990; 189 pp.

Available in January 1992 from Seven Hills Book Distribution, 49 Central Avenue, Cincinnati, OH 45202; 800/545-2005

had known the worst-case potentials of television, or automobiles, or computers or pesticides or robotics or genetics, doubts might have emerged about those technologies as well, and thus slowed their progress.

Technology's Pervasiveness And Invisibility

Marshall McLuhan told us to think of all technology in environmental terms because of the way it envelops us and becomes difficult to perceive. From morning to night we walk through a world that is totally manufactured, a creation of human invention. We are surrounded by pavement, machinery, gigantic concrete structures. Automobiles, airplanes, computers, appliances, television, electric lights, artificial air have become the physical universe with which our senses interact. They are what we touch, observe, react to. They are themselves "information," in that they shape how we think and, in the absence of an alternate reality (i.e., nature), what we think about and know.

As we relate to these objects of our own creation, we begin to merge with them and assume some of their characteristics.

Workers on an assembly line, for example, must function at the speed of the line, submitting to its repetitive physical and mental demands. When we drive a car, we are forced to focus our minds and bodily reactions on being at one with the road and the machine: following the curves, moving through the landscape at appropriate speeds. The more we spend our lives in this manner, the more these interactions define the perimeters of our experience and vision. They become the framework of our awareness.

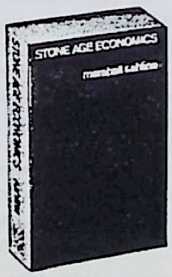
There is a paradox, however. Because technology is now everywhere apparent, pervasive, and obvious, we lose awareness of its presence. While we walk on pavement, or drive on a freeway, or sit in a shopping mall, we are unaware that we are enveloped by a technological and commercial reality, or that we are moving at technological

Stone Age Economics

This book is subversive to so many of the fundamental assumptions of Western technological society that it is a wonder it was permitted to be published. Calling on extensive research among the planet's remaining stone-age societies — in Africa, Australia, and Southeast Asia — as well as anecdotal reports from early explorers, Chicago University Professor Marshall Sahlins directly challenges the idea that Western civilization has provided greater "leisure," or "affluence," or even greater economic reliability, than "primitive" hunter-gatherers. He concludes that far from being on the edge of starvation and having to devote all their time to survival, preindustrial peoples usually satisfied their basic needs in 3-4 hours per day and spent the rest of their time hanging around, flirting, creating art, music, and games, and sleeping. Sahlins also argues persuasively that subsistence-based societies clearly preferred their lives to more settled agricultural ways. He offers extensive research showing that they consistently under-produced, *in terms of the maximum carrying capacity of their environments, just so they would have the ability to move around without dragging surplus food or commodities, and as a means of keeping population down. A Bushman is quoted: "Why should we plant when there are so many mongomongo nuts in the world?"*

Sahlins charges establishment anthropologists and economists with creating imaginary horror scenarios for the purpose of making our society look good by comparison. He describes the traditionally dismal view of the hunter-gatherers' existence as "most congenial for the task of depriving him of the same." In other words, if they ever let it out that subsistence societies "lived banker's hours," as Sahlins puts it, certain questions might arise as to why we stole their lands, paved them, and work 40-50 hours/week, seeking leisure.

—Jerry Mander



Stone Age Economics
Marshall Sahlins, 1972; 348 pp.

$19.95 ($23.45 postpaid) from Aldine de Gruyter/Order Dept., 200 Saw Mill River Road, Hawthorne, NY 10532; 914/747-0110

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When Herskovits was writing his *Economic Anthropology* (1958), it was common anthropological practice to take the Bushmen or the native Australians as "a classic illustration of a people whose economic resources are of the scantiest," so precariously situated that "only the most intense application makes survival possible." Today the "classic" understanding can be fairly reversed — on evidence largely from these two groups. A good case can be made that hunters and gatherers work less than we do; and, rather than a continuous travail, the food quest is intermittent, leisure abundant, and there is a greater amount of sleep in the daytime per capita per year than in any other condition of society.

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The manufacture of tools, clothing, utensils, or ornaments, however easily done, becomes senseless when these begin to be more of a burden than a comfort. Utility falls quickly at the margin of portability. The construction of substantial houses likewise becomes absurd if they must soon be abandoned. Hence the hunter's very ascetic conceptions of material welfare: an interest only in minimal equipment, if that, a valuation of smaller things over bigger; a disinterest in acquiring two or more of most goods; and the like. Ecological pressure assumes a rare form of concreteness when it has to be shouldered. If the gross product is trimmed down in comparison with other economies, it is not the hunter's productivity that is at fault, but his mobility.

speed. We live our lives in reconstructed, human-created environments; we are *inside* manufactured goods.

We do not easily grasp technology from the outside, or in McLuhan's terms, "extraenvironmentally." And once we accept life within a technically mediated reality, we become less aware of anything that preceded it. We have a hard time imagining life before television or cars. We do not remember a United States of mainly forests and quiet. The information that nature offers to our minds and to our senses is nearly absent from our lives. If we do seek out nature, we find it fenced off in a "park," a kind of nature zoo. We need to make reservations and pay for entry, like at a movie. It's little wonder that we find incomprehensible any societies that choose to live within nature.

With each new generation of technology, and with each stage of technological expansion into pristine environments, human beings have fewer alternatives and become more deeply immersed within technological consciousness. We have a harder time seeing our way out. Living constantly inside an environment of our own invention, reacting solely to things we ourselves have created, we are essentially living *inside our own minds*. Where evolution was once an interactive process between human beings and a natural, unmediated world, evolution is now an interaction between human beings and our own artifacts. We are essentially coevolving with ourselves in a weird kind of intraspecies incest.

NO notion more completely confirms our technological somnambulism than the idea that technology contains no inherent political bias. From the political Left and Right, from the corporate world and the world of community activism, one hears the same homily: "The problem is not with technology itself, but with how we use it, and who controls it." This idea would be merely preposterous if it were not so widely accepted, and so dangerous. In believing this, however, we allow technology to develop without analyzing its actual bias. And then we are surprised when certain technologies turn out to be useful or beneficial only for certain segments of society.

A prime example is nuclear energy, which cannot possibly move society in a democratic direction, but *will* move society in an autocratic direction. Because it is so expensive and so dangerous, nuclear energy must be under the direct control of centralized financial, governmental, and military institutions. A nuclear power plant is not something that a few neighbors can get together and build. Community control is anathema. Even control by city or state governments is proving impossible, as is now obvious to those locales attempting to block the movement and disposal of radioactive wastes within their borders.

The existence of nuclear energy, and nuclear weaponry, in turn requires the existence of what Ralph Nader has called a new "priesthood" — a technical and military elite capable of guarding nuclear waste products for the approximately 250,000 years that they remain dangerous. So if some future society, tiring of the present path, should determine to move away from a centralized technological society and

Report from the Frontier

This is an exhaustive report on the condition (as of 1987) of several hundred of the world's surviving native nations. Covering all continents, the book gives historical accounts of the arrival of the colonial powers, the suppression of autonomy, the alienation from native lands and customs, and the current situation. The reports include peoples who have experienced relatively little impact, e.g., certain Amazon nations; those who only recently came under assault, as in New Guinea, the Philippines, Borneo, and the far north; and those indigenous populations who have been subsumed by invader societies. This latter category is the largest, of course, including hundreds of native nations in Indonesia, China, India, Africa, South America, the United States and Canada, and such newsworthy struggles as those in Tibet, Kurdistan, Irian Jaya (West Papua), Ethiopia, Sudan, Guatemala, and the Amazon. Whatever the degree of impact that the native peoples are facing, common themes are clear in their struggles. Each is attempting to maintain cultural identity, political autonomy, and traditional economy in the face of the resource drives of the larger countries.

Population tables, maps, chronologies, resource guides and other helpful devices make ***Report from the Frontier*** *an absolutely basic document for anyone seeking to grasp the big picture on the situation of native peoples on the planet today. If there is a negative to report, it is only that some of the situations have changed rapidly during the past several years, and a few reports are dated.*

—Jerry Mander

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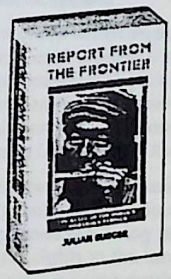
Indonesia recognizes 1.5 million tribespeople officially, with the eastern province of Irian Jaya (West Papua) the most heavily populated, followed by Kalimantan (Borneo), Sulawesi and Sumatra. The tribal peoples are described in the 1945 constitution as those communities inhabiting remote areas 'whose social life, economic performance and level of civilization are below acceptable standards'.



Report from the Frontier
Julian Burger, 1987; 310 pp.

$15 ($17.50 postpaid) from Cultural Survival, 53A Church Street, Cambridge, MA 02138; 617/495-2562

toward, say, an agrarian society, it would be impossible. The technical elite would need to remain, if only to deal with the various wastes left behind. So it is fair to say that nuclear technology *inherently* steers society toward greater political and financial centralization, and greater militarization.

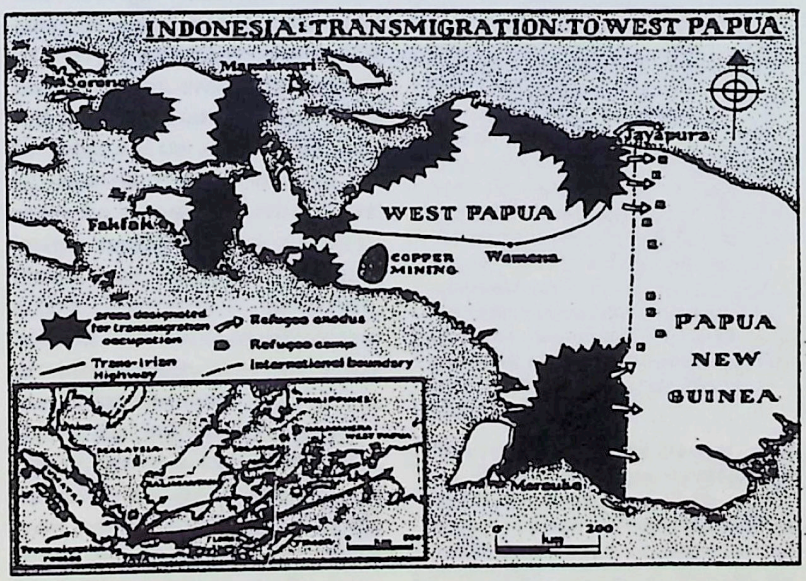
"Holistic" Criticism

I don't think I realized when I began working on *Four Arguments for the Elimination of Television* in 1973 that the project was really a stab at creating a new holistic language by which to discuss television and other technologies. It did not even occur to me at the beginning to advocate *no* television, but merely to broaden the terms used to discuss it, so that all possible dimensions of impact could be included: political, social, economic, biological, perceptual, informational, epistemological, spiritual; its effects upon kids, upon nature, upon power, upon health. A totality of effects, hence a "holistic" viewpoint.

I did place particular emphasis on the negative potentials of television — the worst-case possibilities — since those were absent from most prior analyses. Whatever criticism of television existed at that time

From the political Left and Right, from the corporate world and the world of community activism, one hears the same formula: "The problem is not with technology itself, but with how we use it, and who controls it." This idea would be merely preposterous if it were not so widely accepted, and so dangerous.

Of all the menaces to indigenous peoples in the world, few can be as poignant or as urgent as that threatening the one million or so Melanesian people of West Papua. It is possible with legitimacy to talk about genocide elsewhere — the Mayan Indians in Guatemala, the Ache in Paraguay, the Chakma and other tribal peoples in Bangladesh — but even in the context of such violence the destruction of the West Papuan people has few parallels. More particularly since until very recently the Papuans have had relatively little contact with invading powers and are now experiencing a particularly aggressive and racist colonization from Indonesia. The tragedy is compounded because history is repeating itself so evidently. The invasions of the Americas and especially Australia are being reborn in West Papua, only this time aided by the United Nations and the general assembly of nation states.



Nomadic pastoralism is a highly flexible way of life suited to fragile marginal scrublands. Pastoralists range from purely nomadic groups who travel across the Sahel more or less continuously, locating pockets of pasture and trading, to the semi-nomadic peoples who move their cattle between two regions. . . .

By their successful adaptation to the conditions of the semi-desert regions and their reciprocity with local settled farming communities, pastoralists were able in the past to survive long periods of drought and withstand famine. The pastoralist way of life, far from being an inefficient and primitive mode of production, has proved to be a most effective system for survival and even prosperity. One agricultural adviser has made this comment about the present economic system:

The only form of life which does not threaten the Sahelian environment is nomadism. The continuous movement of men and animals allows vegetation to replenish itself and does not threaten water resources and the grazing land around them.

Yet today the nomadic pastoralists must face serious problems on various fronts. Their grazing lands are being reduced, their traditional rights to the land and water resources are being eroded, the control of herds, pastures and water is increasingly falling into the hands of outsiders and their political power is diminished as they find themselves for the most part a minority people within states dominated by urban elites.

confined itself to the very narrow issues associated with the content of the programs, and ignored the effects of television's existence on society. McLuhan had already told us that "the medium is the message," but there was little evidence that people understood what that meant.

McLuhan was saying that program content may not be the only problem, or even the principal problem, with television. The mere existence of television, he said, causes society to be organized in new ways. As information is moved through different channels its character and its content change; political relationships, concepts, and styles change as well. Even the human spirit and human body change. Because of the way television signals are processed in the brain, thought patterns are altered and a unique, new relationship to information is developed: cerebral, out-of-context, passive.

The point of the book was not to argue that there are no good programs on television. It was to point out that the consequences of television's existence in our society are far more significant than its program content. Ergo, the medium *is* the message. An analysis of television that does not deal with the totality of these effects is not sufficient.

To try and make this difficult point, I originally titled the book *Suburbanization of the Mind*, changing it later to *Freewayization of the Mind*. Both titles were attempts to suggest what was happening to the way that we think and understand information in the television age; our minds were being channeled and simplified to match the channeled and simplified physical environment — suburbs, malls, freeways, high-rise buildings — that also characterized that period (and continue to do so today). This effect would take place, I argued, even if the violence and sex shows and the superficial comedies and the game shows were all removed from the medium, because the process of moving edited images rapidly through a passive human brain was so different from active information gathering, whether from books or newspapers or walks in nature. As a result people would become more passive, less able to deal with nuance and complexity, less able to read or create. People would get "dumber," and have less understanding of world events even within an exploding information environment. The book predicted that a new kind of leader would emerge from this process, one who fit the parameters of the medium, and who understood its language: simple, assertive, without history or context, with style superior to content. A few years later, Ronald Reagan became the personification of that prediction.

I LOOKED into the literature about television to find the names of other writers who had also taken a stance against it. I was startled to learn that nearly 10,000 books had been written about television since 1945, but not one of them argued that our society would be better off without it. Why had nobody ever made such a case?

Here was a technology that entered every home in the United States, brought imagery nightly into every brain for many long hours, reorganized family life, community life, political life, human understanding and experience and, through their advertising and their domination of program content, gave corporations an unprecedented degree of centralized power and control. Yet no one had thought to argue that we might be better off without it. Why? Did everyone really believe that TV was great? Definitely not.

Trilateralism

If you want to understand the roots of George Bush's "new world order," go back and (re)read this 1980 book about the scheming of the infamous Trilateral Commission. Created in 1973, the commission was composed of 300 industrial, banking, and political leaders in the Western developed countries. The US participants included the likes of Henry Kissinger, George Bush, Jimmy Carter, Walter Mondale, Carla Hills, David Rockefeller, Zbigniew Brzezinski, Paul Volcker, David Packard, Caspar Weinberger, George Weyerhaeuser and their exact counterparts in Japan, England, France, Germany, and all the other developed countries. No partisan squabbling in this crowd. They were all in agreement on a philosophy of development and organization that placed the economic elites in charge of a one-world economic plan, which would eventually have all places looking like San Jose, California.

They got together a few times each year and developed strategies for influencing their own countries, and all others, for smoothing the pathways toward unlimited industrial production, an unhindered free-trade system, free flow of resources, suppression of environmental laws, promotion of commodity consumption and the continuous exploitation of the natural world. Diversity of culture, diversity of lifestyle, and the maintenance of indigenous place-based economies were (and are) subversive to the Trilateral dream. The goal was unity of purpose among all countries toward a common economic-political dream.

The wrinkle in the piece was that a large part of the world was then communist, but now, with the defection of the USSR and all the Eastern Bloc countries to market economics and capitalism, combined with the creation of such international monoliths as the IMF, the World Bank, and the General Agreement on Tariffs and Trade, worldwide homogenization under transnational corporate control is a realizable goal.

This is the ultimate conspiracy book; a conspiracy made more plausible by the fact that the conspirators are not military or fascist zealots; they are men and women who graduated from good schools, who want world peace and two cars in every garage, whether in Des Moines, the jungles of New Guinea, or on Mars. The book confirms that the world is run

But everyone *was* caught up in the narrow idea that programs were television's only problem; the solution was simply to produce better programs, to slip new ideas into the medium.

There was yet a deeper resistance. Saying no to a technology, *any* technology, was (and still is) beyond us. Virtually unthinkable. It does not even occur to most of us that we have the right or ability to turn back a whole technology. No precedent and no support exists for it in our culture.

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In a truly democratic society, any new technology would be subject to exhaustive debate. That a society must retain the option of declining a technology — if it deems it harmful — is basic. As it is now, our spectrum of choice is limited to mere acceptance. The real decisions about technological introduction are made by only one segment of society: the corporate, based strictly on considerations of profit. This is clearly antithetical to the democratic process.

AT the turn of the century the car was portrayed as a harbinger of personal freedom and democracy: private transportation that was fast, clean (no mud or manure), and independent. But what if the public had also known about the negative properties of the car? What would have been the outcome?

What if the public had been told that the car would bring with it the modern concrete city? Or that the car would contribute to cancer-causing air pollution, to noise, to solid-waste problems, and to the rapid depletion of the world's resources? What if the public had been made aware that a nation of private car owners would require the virtual paving of the entire landscape, *at public cost*, so that eventually automobile sounds would be heard even in wilderness areas? What if it had been realized that the private car would only be manufactured by a small number of giant corporations, leading to their acquiring tremendous economic and political power? That these corporations would create a new mode of mass production — the assembly line — which in turn would cause worker alienation, injury, drug abuse, and alcoholism? That these corporations might conspire to eliminate other means of popular transportation, including trains? That the automobile would facilitate suburban growth, and its impact on landscapes? What if there had been an appreciation of the psychological results of the privatization of travel and the modern experience of isolation? What if the public had been forewarned of the unprecedented need for oil that the private car would create? What if the world had known that, because of cars, horrible wars would be fought over oil supplies?

Would a public informed of these

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by a small group of wealthy corporate types, who are in conceptual agreement and who get together to help move the whole ship forward. Their names, addresses, and affiliations are dutifully noted. —*Jerry Mander*

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Consumption is the locomotive of profit. In 1968 *Forbes* magazine (which proudly calls itself the "Capitalist Tool") featured the views of Nabisco's president, Lee Bickmore, on shaping "one world" of homogeneous consumption. Bickmore captured the corporate dream, looking forward to the day when

> Arabs and Americans, Latins and Scandinavians will be munching Ritz crackers as enthusiastically as they already drink Coke or brush their teeth with Colgate.

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Trilateralists look forward to a pseudo postnational age in which social, economic, and political values originating in the trilateral regions are transformed into universal values. Expanding networks of like-minded government officials, businessmen, and technocrats — elite products of Western education — are to carry out national and international policy formation.

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Countries are continually bombarded with images of the fantasy American Dream. In countless ways the message of the dominant system penetrates: the Western Way is the good way; national culture is inferior. This is the meaning of cultural penetration or cultural imperialism. Mass advertising, Voice of America radio, educational sponsorships are all designed to shape tastes, beliefs, practices, and aspirations in the image of the West. Foreign economic and military aid are less subtle means of influencing other countries.

Trilateralism
Holly Sklar, Editor. 1980; 604 pp.
$20 ($23 postpaid) from South End Press, P. O. Box 741, Monroe, ME 04951; 800/533-8478 (or Whole Earth Access)

factors have decided to proceed with developing the private automobile? Would the public have thought it a good thing? If so, would there have been greater efforts to control the overbuilding of roads, or to protect alternative transit forms? How might the auto's impact on society have been modified as a result?

I really cannot guess whether a public so well informed, and given a chance to vote, would have voted against cars. Perhaps not. But the public was *not* so informed. There was never any vote, nor any real debate. And now, only three generations later, we live in a world utterly made over to accommodate the demands and domination of one technology.

With corporations, as with television, the basic problems are actually structural. They are problems inherent in the forms and rules by which these entities are compelled to operate. If the problems could be traced to the personnel involved, they could be solved by changing the personnel.

GIVEN the extent to which corporations affect both technical change and the forces of nature, it is surprising how little attention we give them. It's not that we are entirely unaware of them; we hear their names trumpeted and flashed at us whichever way we turn. But most of us accept their existence unquestioningly, unconsciously, like background noise. We don't focus on them as the primary players they are, and we have very little understanding of *why* they behave as they do.

We usually become aware of corporate behavior only when a flagrant transgression is reported in the news: the dumping of toxic wastes, the releasing of pollutants, the suppression of research regarding health effects of various products, the tragic mechanical breakdowns such as at Three Mile Island, in Bhopal, or at Prince Edward Island in Alaska. Sometimes we become concerned about a large corporation closing a factory, putting 5,000 people out of work, and moving to another country.

Even when we hear such news, our tendency is to respond as if the behaviors described stem from the *people* within the corporate structure — people who are irresponsible, dishonest, greedy, or overly ambitious. Or else we attribute the problem to the moral decline of the times we live in, or to the failure of the regulatory process.

Seeing corporations' behavior as rooted in the people who work within them is like believing that the problems of television are attributable solely to its program content. With corporations, as with television, the basic problems are actually structural. They are problems inherent in the forms and rules by which these entities are compelled to operate. If the problems could be traced to the personnel involved, they could be solved by changing the personnel.

Unfortunately, however, *all* employees are obliged to act in concert, to behave in accordance with corporate form and corporate law. If someone attempted to revolt against these

When Technology Wounds

Is there anyone you know who does not have a "better-suffering-through-technology" personal horror story? We all seem to be awakening at once from the dream of blessing to the nightmarish curse of a technologized environment from which there is apparently no escape. Even CEOs have DES daughters.

Chellis Glendinning first reveals her own wound as a technology survivor of birth-control pills and devices. From IUDs to atomic bombs, When Technology Wounds explores the psychological fallout from technology's explosion through the tales of survivors across America. Meet June Casey, a college student downwind of Hanford Nuclear Reservation in Washington; Jose Luis Roybal, a guard in Hiroshima after the bombing; Gay Ducey, a mother-to-be who sprayed her church lawn with a common weed-killer; and 43 other victims of technology. Love Canal, asbestos, contaminated tap water, gas-station hazards, red dye no. 2, Agent Orange, video-display-terminal radiation, "environmental illness" — this book has it all, and so have we.

Although the specific causal agents vary from case to case, the root cause and the resulting syndromes of ill health and despair remain the same; Glendinning makes this bigger picture very clear. And because, with important exceptions like Hanford, long-term controlled experiments on the effects of toxic elements on humans is simply not done (at least, not overtly), "anecdotal," rather than "scientific," evidence is really all we've got to go on. As the book shows, that's more than enough. I know some of these people; chances are you do too.

—Robin Bishop
[Suggested by Phil Catalfo]

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According to psychologist Paul Scipione of the New Jersey State Agent Orange Commission, if the government can stave veterans off until the mid-1990s, the dioxin in their blood and fatty tissue will have been excreted. Dioxin-caused diseases will be unprovable, and admission of fault will be a moot point. The government appears to be executing this strategy. It refuses to allocate money for studies that would link exposure levels to illness, and instead it conducts research like the Air Force "Ranch Hand" study of pilots and crews who flew

tenets, it would only result in the corporation throwing the person off, and replacing that person with another who would act according to the rules. Form determines content. Corporations are machines.

THE failure to grasp the nature and inevitabilities of corporate structure has left our society far too unconscious and passive to corporate desires, and has helped corporations increase their influence, power, and freedom from accountability. Corporations already influence our conceptions of how life should be lived more than any other institution, including government. Corporate ideology, corporate priorities, corporate styles of behavior, corporate value systems, and corporate modes of organization have become synonymous with "our way of life." Corporate "culture" has become the virtual definition of American life, to be defended at all costs, even militarily. When Secretary of State George Schultz said in 1985 that in Nicaragua and El Salvador "we are fighting for our way of life," it was the threat of collectivism to free enterprise and commodity culture that motivated his remarks. Conversely, when our leaders celebrate the new "freedom" of Eastern Europe, they are really celebrating free enterprise and the market economy.

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Living in the United States today, there is scarcely a moment when you are not in contact with a corporation, or its manifestation.

It is very likely that you work for a corporation. If so, your daily schedule is determined by corporate needs. You dress and behave according to corporate concepts, you interact with the machines by which corporations accomplish their tasks — computers, typewriters, telephones, fax machines, copiers. You spend your day living within corporate rhythms.

The building you live in was probably created by a corporation, as were your furniture, appliances, the clothes in your closet, your perfume; all the result of corporate concepts and action.

Taken as a group, corporations are the largest landowners in the United States, with the exception of the federal government. Corporations are also the major financial backers of electoral campaigns, and the major lobbyists for laws that benefit corporate goals.

If you switch on your radio or television, or open your newspaper, corporations speak to you. They do it through public relations and through advertising. American corporations spend more than $100 billion yearly on advertising, which is far more than is spent on all secondary education in this country. In some ways corporate advertising is the domi-

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spraying missions, a study that may not be concluded until the year 2002. By that time dioxin levels in surviving veterans will be impossible to detect, and most veterans who currently have Hodgkin's disease, lymphoma, or the neurological disorders thought to be associated with dioxin will be dead.

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I went to my son's pediatrician, and I said, "Look, there are eight patients who have you as their doctor. All of them are under the age of twelve, all of them have a similar urinary disorder. Why is this? What do you make of the fact that you have eight patients who live within a few blocks of Love Canal who have *the same disease?!*" He said, "There is no connection."
—*Lois Gibbs*, Love Canal resident

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When Jane Woolf found out that the well water she had been drinking at her home in Michigan was contaminated by a gasoline leak across the highway, she also learned that the benzene in the gas could cause leukemia. "I was extremely worried," she says. "I had an overwhelming fear of death gnawing at me. Just thoughts running through my mind all the time. Who will I make my will out to? I wonder if I'll ever have any kids? I wonder if I'll ever have a family life?"

When Technology Wounds
Chellis Glendinning, 1990; 285 pp.
$18.95 ($20.45 postpaid) from William Morrow and Co./Wilmore Warehouse, 39 Plymouth Street, Fairfield, NJ 07004; 800/843-9389
(or Whole Earth Access)

nant educational institution in our country, surely in the realm of lifestyle.

The average American now views 21,000 commercials every year. Twenty-one thousand times, corporations place images in your brain to suggest something great about commodities. Some commercials advertise cars, others advertise drugs — but all commercials agree that you should buy *something*, and that human life is most satisfying when inundated with commodities. Between commercials there are programs, also created by corporations, that espouse values consistent with the ads.

Some commercials advertise cars, others advertise drugs — but all commercials agree that you should buy something, and that human life is most satisfying when inundated with commodities. Between commercials there are programs, also created by corporations, that espouse values consistent with the ads.

Corporations are also the major providers of educational materials for American schools. Some of the largest corporations now provide books, tapes, films, and computer programs free of charge to public and private schools, as a "public service" in these budget-conscious times. They get a lot of praise for these contributions. Oil and chemical companies have been particularly generous in providing materials to help explain nature to young people: materials that portray nature as a valuable resource for human use, and that celebrate concepts like "managing nature" through chemicals, pesticides, and large-scale agribusiness. Thus a generation of youngsters is trained to regard nature in a way that coincides with corporate objectives. They are also trained to accept corporate interpretations and perspectives from a very early age, and are thereby prepared for what is to come. ❦

The American Replacement of Nature

This is a great rabid rant about what America, technology, and the new religion of Disneyism are doing to the world. I don't agree with a lot of it but the part I agree with has changed a lot of my former enthusiasms for the wonders of technology, and redirected large chunks of my attention to the man behind the curtain. It's undeniable that the quick-cut, sound-bite, fast-food, Disneyland-sanitized, corporate-sponsored world-as-constructed-experience has replaced a lot of real estate that used to be occupied by the real — forest or desert.

As usual, you can't judge Thompson's book as a logical argument; you have to enjoy it as a full-frontal assault by an enraged and literate thinker. The prose isn't always lucid, but the diatribes hit some very interesting targets dead center.

—Howard Rheingold

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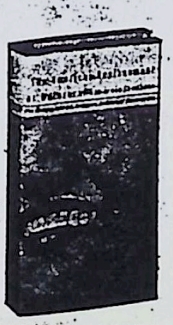
Technologies will become ensouled, just as souls become denatured and shifted into collective lattices rather than into the animal-hominid bodies of old evolutionary times. "Demons" will be able to take human form, and souls will be able to dwell in cognitive lattices, so it is small wonder that today's science-fiction landscape of novels and computer games is filled with mythologies of dungeons and dragons, monsters and devils. This paranoia is crazy, but the caricatured sketch reveals an isomorphism to an evolutionary *metanoia* that is beyond anything we could call normal. One can clue into this phenomenon of cultural evolution through the paranoid caricatures of the fundamentalists — who curiously seem to object to the Luciferic New Agers more than the Ahrimanic technologists in computer science — or one can clue into it through cyberpunk fiction, or one can get more than a clue if one reads Steiner and realizes that what one is looking at in the new electronic America so celebrated and hyped by Stewart Brand and Howard Rheingold is a collectivization that can be mythologically identified as the incarnation of the demon Ahriman.



The American Replacement of Nature
William Irwin Thompson, 1991; 160 pp.
$20 ($22.50 postpaid) from Doubleday & Co./Fulfillment Dept., 2151 S. Wolf Road, Des Plaines, IL 60018; 800/223-6834 (or Whole Earth Access)

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The logo for this, the world's first multinational corporation, was not a happy mouse, but an instrument of execution. Martyrs were its heroes and sources of inspiration for countless paintings that often went into gruesome detail of the frying or dismemberment of God's most favored ones. Churches were intimidating spaces of much darkness and little light, great echoing vaults in which the leftovers of martyrdom were saved as relics to impress the unthinking and cure the faithful. By governing the body through the power of an overwhelming and impossible denial of its physical existence, the Church took control of life at its deepest roots of sex and death. But it would be the future that it presumed to control that would undo it, and while its attention was focused on stopping intellectuals from reading forbidden books and preventing lovers from having sexual relations without the conjugal bond and a commitment to reproduction, a new prophet arose in our midst in L.A. who was so deceptively camouflaged that to this day most people think of him as an enormously successful businessman and not as the influential founder of a new world religion.

PART TWO:

TECHNOLOGY HISTORY

PART THREE:

TECHNOLOGY ISSUES

TECHNOLOGY AND POLITICS

TECHNOLOGY AND SOCIETY

TECHNOLOGY AND THE DEVELOPING WORLD

TECHNOLOGY AND WOMEN

ASSESSING TECHNOLOGY

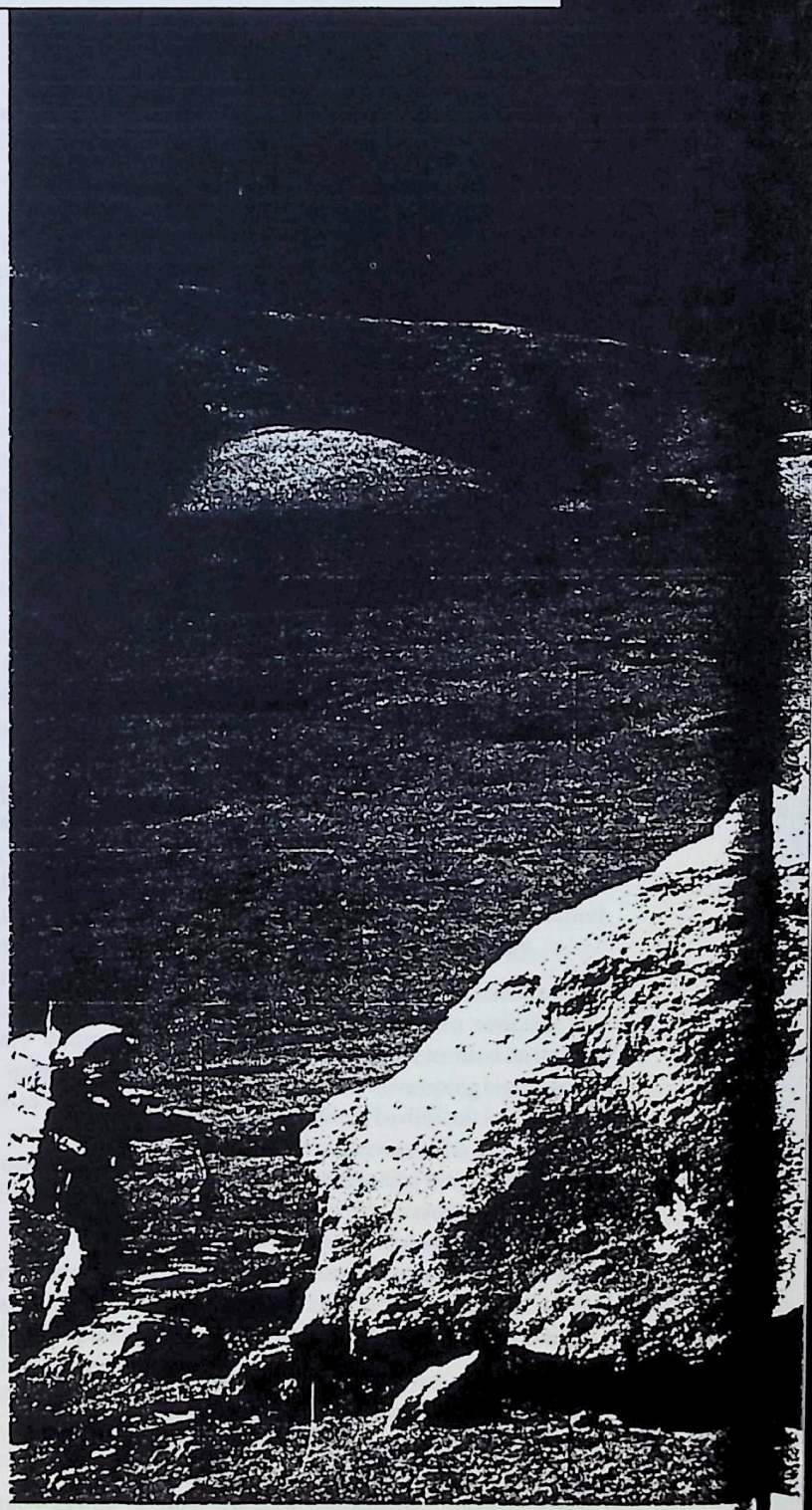
NASA Goes To Ground

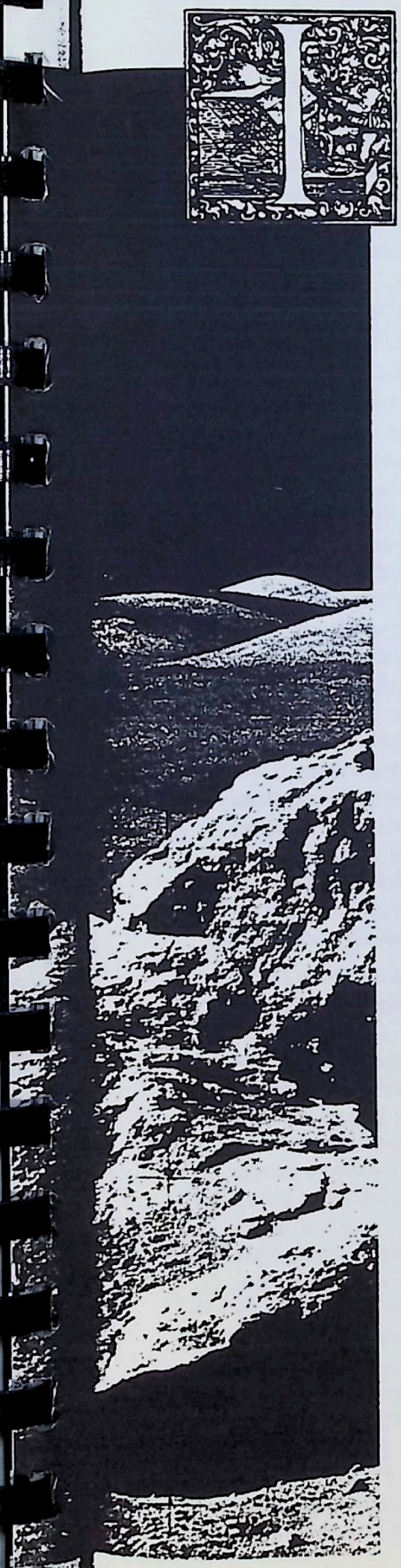
BY WENDY ALTER AND JAMES S. LOGAN

Twenty-five years ago, NASA was an enterprise of mythic, heroic quality. The popular phrase for planetary problem-solvers was "If they can put a man on the moon, they can . . . ." But now, even technophiles argue against government-funded Big Science on the ground that "these are the same people who brought us NASA." How did something that once worked so well turn into something that doesn't? The authors of this article have the background for tackling a question like that. Because there are so many armchair theorists in this particular field, Alter and Logan's backgrounds are worth noting.

In the eighties, Wendy Alter worked at Marshall Space Flight Center for several years in the Space Sciences Laboratory. She accumulated about five hours' weightless experience on NASA's KC-135 low-gravity-simulation aircraft. ("At 30 seconds of weightlessness per parabolic maneuver, followed by a 2-g pullout, flying up to 40 parabolas in succession, that's a hell of a rollercoaster ride! In fact, Jim and I met for the first time under weightless conditions.") She directed research on advanced shuttle materials, especially turbine-blade superalloys, and was with NASA when the first shuttle was launched. Alter was working in the Failure Analysis branch at the time of the Challenger explosion, where she assisted in testing and performed data analysis for the O-ring investigation. She left the agency in 1988.

James S. Logan, M.D., joined NASA in 1982 and spent two years as chief of the Flight Medicine Clinic at Johnson Space Center, as personal physician to the astronauts and their families. Then he served as chief of the Medical Operations Branch (Life Sciences Division) for three years, providing direct medical support for 25 shuttle missions. During that time he was project manager for the Space Station Health Maintenance Facility, directing a team of 25 physicians, engineers, and technicians responsible for requirements definition and design of the clinical medical facility for the space station. He managed the Life Sciences Division of the Space Station Office for two years, then moved to NASA Headquarters in 1988 where he served as: Manager, Aerospace Medicine; Life Sciences Liaison Officer, NASA Space Station Program Office, Reston, VA; and President, Space Medicine Branch of the Aerospace Medical Association. Jim led NASA's telemedicine team after the earthquake in Armenia; he left the agency in 1989.
—Howard Rheingold





IT WAS THE BEST OF TIMES. A young, aggressive, confident government organization, in partnership with America's premier aeronautics industries, had succeeded in doing the impossible: putting a man on the moon in eight short years. The National Aeronautics and Space Administration, barely eleven years old at the time, became the symbol for American technical, scientific, and operational superiority. No one imagined that NASA would go anywhere but up.

Giants stalked the halls of NASA at headquarters in Washington and at the field centers in Houston, Cape Canaveral, Huntsville, Pasadena, and Moffet Field. Men like Werner von Braun, Robert Gilruth, George Low and others became legends in their time. Unafraid to take risks or accept responsibility, they inspired by example and harnessed the collective brainpower, sense of purpose, and enthusiasm of those they managed. The space program brought out the best in almost everyone. Working at NASA wasn't just a job, it was The Mission: human beings were breaking the bounds of the planet, and this was The Team that was making it happen. The flurry of spectacular successes spawned a generation of NASA wannabes.

Not that there weren't obstacles. Created under the auspices of the Space Act of 1958, NASA became part of the Executive Branch of government, which meant that it was civil service. The administrator and deputy administrator were chosen by the president to implement the president's own space agenda. As part of a strategy to develop and maintain a constituency in Congress, NASA installations were decentralized to Texas, Florida, California, Ohio, and Alabama. And the space agency had to go to Congress yearly for funding. As part of the discretionary budget, NASA competed head to head with everything from housing for the poor to the VA and the EPA. Early on, space proponents were put on the defensive by those who believed in solving problems on Earth before going into space.

Fortunately for NASA, administrations were supportive and the public was awed. There were even those who advocated the space program as a moral and economic alternative to war. After all, the frontier was integral to the American Dream — and America was fresh out of both.

Unfortunately, the US had gone into space for the wrong reasons. Our goal was to win a contest, a space race. We went as an exercise in national self-aggrandizement, not because space had any perceived intrinsic value. To be fair, there were scientific discoveries along the way, and numerous spin-offs to the private sector, but exploration and discovery were never real justifications for the space program.

Barely a year after the Eagle had landed, the Nixon administration canceled the final four planned missions to the Moon, and the demobilization of the most successful technical organization in history was begun. NASA saw its work force cut by 40 percent; its budget, which reached a peak of 4.5 percent of the 1967 federal budget, had been slashed by over 75 percent by 1974. Even before the Apollo program ended in 1972, it was clear that NASA was losing much of its most creative talent. Whereas the 1960s had seen tremendous growth in the space agency, the 1970s were a decade of retrenchment. From the end of the Skylab program in 1974 to the first flight of the space shuttle in 1981, only one manned mission was flown: the Apollo-Soyuz test project in the summer of 1975, performed for political reasons with ten-year-old technology.

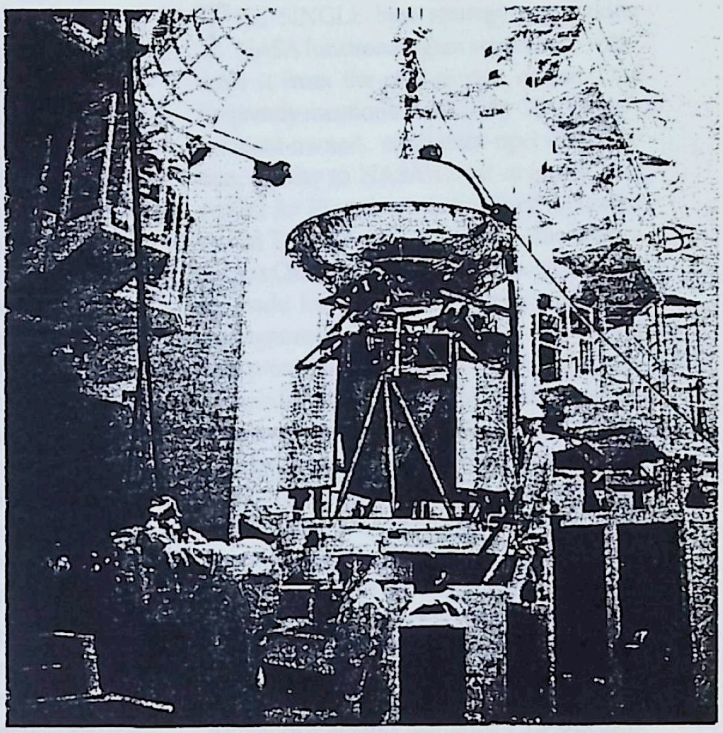
IN THE ABSENCE of a clear mandate and a higher vision, during the seventies the agency's attention became focused on its own survival. This meant developing big, ongoing programs that would be difficult for Congress to cancel once underway. The agency occupied itself with increasing bureaucratization; layers and layers of management evolved, fiefdoms were carved out among the Centers and within them. Communication between the far-flung installations dwindled as the Dark Ages of space exploration descended.

As its organizational survival strategy, NASA sought to eliminate competition to the space shuttle for access to low Earth orbit. The shuttle became the Space Transportation System (STS), a designated "national asset."

Through deft political maneuvering and with a blind eye to the shuttle's obvious operational deficiencies, the agency successfully lobbied to become the only pathway to orbit for most American payloads. Success would guarantee continued existence for NASA as a transportation service. No one acknowledged that this policy created a giant single-point failure, nor was much attention given to developing strong justifications for making the trip in the first place. The hardware was more important than its purpose.

The isolation of internal organizations from each other led not only to rivalry between Centers but also to the entrenchment of an inefficient, bureaucratically intensive "over-the-wall" approach to the design, fabrication, and test of flight hardware. NASA's modus operandi now, this process is a series of largely independent steps: A planning team develops requirements for a piece of hardware. They throw the requirements "over the wall" to a completely different team, which generates specifications. From there, it is thrown over the wall again to a fabrication team, which builds a prototype. Then over the wall to materials, safety and reliability, flight hardware construction, flight certification, training, and so on. There is little interaction and virtually no feedback. Any post-design changes ripple back through the system causing major trauma, significant time delays, and huge cost overruns.

NASA's solution to the problem? More bureaucracy. Change Boards were set up to literally prevent changes by imposing such paperwork hurdles that all but the most imperative modifications were denied. Layers of jobs sprouted around each function and the turf became yet more clearly delineated. Far from the state-of-the-art organization it is portrayed to be, the agency has routinely been forced to "freeze" technology seven to ten years prior to a mission just to get a piece of hardware from conception to flight. This is compounded by the growing trend to contract out not only most aspects of design, fabrication, and testing of hardware, but studies, technology assessments, and fundamental research as well. NASA engineers and scientists function increasingly as contract managers, growing more distant from the hands-on hardware development or research process. And the first imperative of the prime aerospace contractors — the maintenance of plum "cost-plus" government contracts — clearly does not contribute to rapid, efficient problem-solving.



(Above) Under sterile conditions, technicians mate the Viking I orbiter and nuclear-powered lander in preparation for the August 1975 launch. This was the first American space vehicle to land on another planet. Despite this success, the Viking program has been supplanted by the Space Transportation System (aka the space shuttle) and the Space Station program.

(Opposite) The space shuttle Challenger hurtles skyward on its June 1983 launch. Bureaucratic bungling was responsible for its explosion in January 1986.

DURING NASA's post-Apollo organizational retrenchment in the seventies, the climate in the ranks became more attractive to civil servants than to bold thinkers. The ponderous procurement system and increasingly outdated facilities were tolerated by employees who had nothing much more important to do than fight their way through paperwork. For a decade there was virtually no hiring at NASA, no new blood, no new ideas. Those who enjoyed the government benefits and didn't mind working in an undemanding atmosphere remained and eventually began filtering up into management positions. The unofficial motto became "Don't rock the boat," and this was directed not just against agitators, but also against achievers whose enthusiasm might arouse potentially embarrassing expectations.

By the time the shuttle was ready to fly, the agency was so mired in bureaucracy that meeting the challenges of an active flight schedule proved difficult. To compound the

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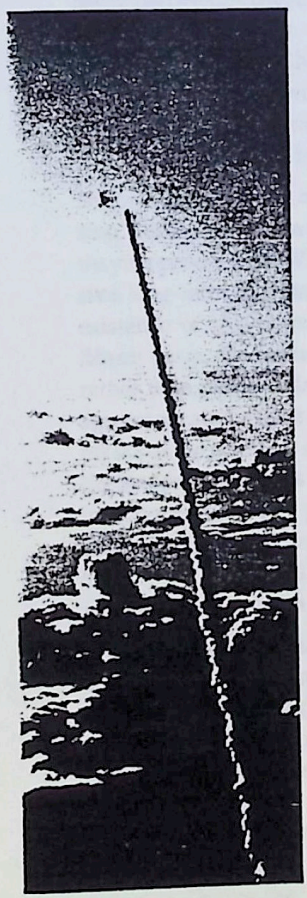


problem, the older engineers, those with Apollo experience, were by now retiring in droves. Finally the ten-year hiring freeze was lifted, and an effort was made to attract fresh best-and-brightests. However, the civil-service system made it extremely difficult to bring in outside experienced (i.e., expensive) senior-level personnel, while hiring co-op students and fresh graduates to fill the trenches was comparatively easy. Despite programs initiated to develop professionalism in the young recruits, the general experience level in the ranks dropped alarmingly.

The agency desperately needed people who were genuinely interested in working. The new generation of scientists and engineers found they could assume as much responsibility as they were willing to accept. Some of the young people proved to be real firebrands in the old NASA tradition, struggling to revitalize sluggish projects, reform wayward contracts, refurbish outdated facilities. Yet the stifling civil-service environment created frustration at every turn. Some left for private industry. Others stayed, but made the decision to "stop caring so much."

In the mid-eighties, things really began to go wrong. Problems grew larger, more frequent and stubbornly persistent. A common response was not to seek the swiftest and best solution, but to seize upon problems as opportunities to build turf, justify facilities' expansion, and compete for funding. Management, uneasy about accountability in decision-making, proceeded to insulate itself by creating a plethora of committees to "study the problem" and come up with tepid recommendations that would not undermine the status quo. Dissent was anxiously avoided, information duly sanitized. The launch decision that resulted in the Challenger explosion finally brought NASA's inadequacies before the eyes of the public.

THE SINGLE best strategy for making NASA functional again would be to withdraw it from the civil-service system. One frequently mentioned idea is the GOCO (government-owned, contractor-operated) option, similar to NASA's own uniquely successful Jet Propulsion Laboratory (operated by Cal Tech) or various national laboratories such as Oak Ridge and Los Alamos. A case can be made for putting the agency under the management of a top university consortium and providing committed funding (i.e., authorized several years in advance) to permit long-term planning. The traditional intellectual independence of the academic community, its insistence on "good science," might confer some protection from political pressures in program decisions. As other pluses, the university network would provide ready access to a broad range of expertise and could further encourage international scientific cooperation.

Although academia has its own management pitfalls, as contractor it would liberate NASA from a variety of deadly civil-service obstructions. Through unrestricted hiring policies and salaries competitive with the private sector, for example, crucial experience and creativity could be attracted (and retained). At the same time, civil service's tenure-gone-wild policies must be terminated. And rigorously streamlining the procurement system should eradicate the typical three- to twelve-month delays.

Over-the-wall engineering must be replaced by concurrent engineering, in which a "tiger team," consisting of representatives of all departments and/or organizations responsible for getting a piece of hardware out the door, manages the process from end to end. Numerous studies have demonstrated that when those responsible for design, engineering, fabrication, testing, materials, and operations sit down together at the beginning of a project and attempt to prevent problems, the result is shorter development time, fewer engineering changes, and significantly higher overall quality.

Finally, NASA must commit to a new leadership style, creating by merciless débridement a lean, efficient, powerful, and fully accountable management. Emphasis should be given to developing versatile, long-term laboratory

capabilities rather than project-specific facilities; the organizational structure of the agency should reflect this policy.

But restructuring alone will not be sufficient to revitalize the agency. NASA not only needs a new approach, it desperately needs a new vision. Fundamentally, NASA fails to make a case for space that resonates in the hearts of its present congressional and tax-paying supporters. Recent presidents have chosen to use NASA for promoting American public relations, rather than to pursue a sincere commitment to its ostensible role as technological innovator. The apple-cheeked, red-white-and-blue image which has been created for NASA is entertaining for schoolchildren but permits no embarrassing public failures, nor does it inspire the thrill of true discovery which entails risk and requires genuine heroes and intellectual adventurers.

If a lack of vision for the agency helped create the present condition, the civil-service system keeps it that way. Many upper-level NASA managers and laboratory engineers admit sadly that NASA could not now return to the moon in eight years. It's not just that the infrastructure from the Apollo program is gone and the agency would have to start from scratch. The painful conviction is that it literally couldn't be done by the present agency.

Unfortunately, NASA only knows one song to sing. The Space Station program provides dismaying proof of this. Viewed as another massive, long-term program which will justify the existence of the agency for another ten or fifteen years, the focus is again on hardware rather than purpose. In fact, there is no clear agreement about what the Station will do. In a replay of the mistakes of the shuttle program, the Station was sold as all things to all people, incorporating every possible activity that might be conceived for a weightless environment with an orbital vantage — many of which are just physically incompatible.

Clearly, for a facility as complex as the Space Station, a comprehensive, meticulous systems-design effort with emphasis on concurrent engineering is mandatory. Yet the national political climate induced the agency to adopt the deplorable (but so far successful) strategy of rushing to bend metal as quickly as possible so that Congress would not cut the program. During the initial design of the station, managers were committed first to establishing a program, no matter how badly flawed. The attitude was, "We'll fix it later."

Even more dismaying is the proposed Mission to Mars, a poignant attempt to recreate the glory of the Apollo days. At a tremendous cost, Americans get flags, footprints, and rocks — but no permanent infrastructure, nothing with which to build a secure presence in space, or to solve the problems of our own planet. Even the pure scientific information from such a mission could be obtained more easily and inexpensively with unmanned probes. Again the president is seeking to wave NASA like an American flag rather than asking which aspects of space technology would give us the best return on our investment.

Restructuring alone will not be sufficient to revitalize the agency. NASA not only needs a new approach, it desperately needs a new vision.

The climate in America today will not support such an attempt. The president and the space agency should read the pulse of the country and choose instead to focus on one of the other proposals that have been offered for consideration: Mission to Planet Earth. The resources of space technology could be best utilized to investigate the complexities of our own planet and the requirements of the life it supports. (The discovery of the loss of atmospheric ozone is one well-known example of such a function; establishing a global telemedicine network might be another.) A powerful, effective research organization dedicated to this mission is badly needed and would garner popular support. Even those with little enthusiasm for space activities are enraptured by NASA's beautiful photo of our blue planet glowing against the vast black emptiness of space. There is deep emotion here, a longing and an energy waiting to be tapped. If NASA is to be revitalized, Earth, not space, may be the source of its vision and its constituency.

The agency seems either unwilling or unable to commit to developing a lasting and reliable space infrastructure, or to a space program in tune with the pressing global environmental issues of the twenty-first century. The authors consider themselves proponents of both. As it stands, unfortunately, being pro-space and pro-NASA may be mutually exclusive. ❦

Winning The Peace

BY HIS ACTIONS in recent months, Saddam Hussein has proved to the world that he is a malevolent man. (The Kurds on whom he dropped poison gas, of course, knew this years ago.) But the U.S.' willingness to confront Iraq hardly sprang just from an altruistic desire to liberate Kuwait: a half-million troops would not have been sent if Kuwait merely grew broccoli.

This has been cast as a war between good and evil, but it was also a war about oil — who controls it and how much it will cost. It was both a moral war and a resource war; a war against Hussein and a war *for* energy. After the war, the energy issues remain. Will this war strengthen America's resolve to reduce its dependence on foreign oil? Or will it, ironically, have the opposite effect? Having won the war, can we win the peace?

For decades, one of the veiled, unstated principles of U.S. energy policy has been: "Maintain access to Middle Eastern oil, regardless of economic, environmental, political, or military costs." But as this war demonstrated, the true costs of a barrel of Persian Gulf crude are far larger than its nominal price. Since this is unlikely to change, it seems reasonable to ask: in the decades to come, are our strategic and economic interests best served by preserving access to Persian Gulf oil — or by eliminating our need for it? Whatever the rationales for this war, we don't need to depend on oil from the Gulf — and it's cheaper not to.

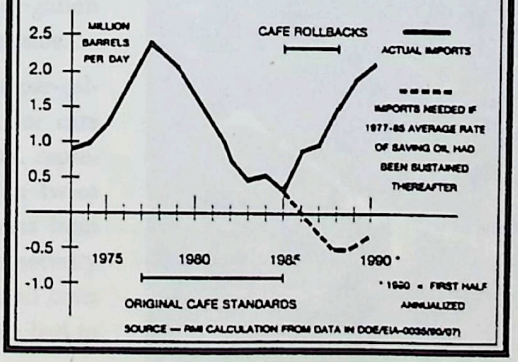
More simply, did we put our kids in tanks because we didn't put them in efficient cars? The answer is yes. Americans wouldn't have needed *any* oil from the Persian Gulf after 1985 if we'd simply kept on saving oil as quickly as we did for the previous nine years (graph 1).

Even now, we could still roll back the oil dependence that perpetually holds our foreign policy hostage and distorts other U.S. priorities in the Middle East. We could eliminate all Gulf imports by using only an eighth less oil.

For example, improving America's 19-mile-per-gallon household-vehicle fleet (graph 2) by three miles per gallon would replace U.S. imports of oil from Iraq and Kuwait. Another nine miles per gallon would end the need for any oil from the Persian Gulf and, according to the Department of Energy, would cut the cost of driving to well below pre-war levels without sacrificing performance.

Graph 1

Net U.S. Imports of Oil from the Persian Gulf



The New York Times published a slightly different version of this piece six weeks before the Gulf War broke out. Amory and Hunter Lovins are the founders of the respected and sassy Rocky Mountain Institute.
—J. Baldwin

BY AMORY B. LOVINS
AND HUNTER L. LOVINS

The Reagan Administration doubled 1985 oil imports from the Gulf when it rolled back light-vehicle efficiency standards. Today's new cars average 29 miles per gallon. Yet ten manufacturers have built and tested attractive, low-pollution prototype cars that get 67 to 138 miles per gallon. Better design and stronger materials make some of these safer than today's cars, as well as more nimble and peppy.

And efficiency needn't mean smallness: only 4 percent of past car-efficiency gains came from downsizing. Some of the prototype cars comfortably hold four or five passengers, and two of them are said to cost nothing extra to build.

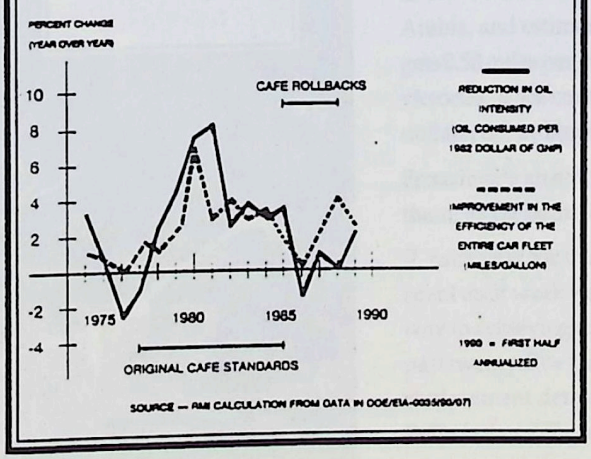
Many other oil savings can help. Boeing's new 777 jet will use about half the fuel per seat of a 727. Technical refinements can save most of the fuel used by heavy trucks, buses, ships, and industry. Insulation, weatherstripping, and simple hot-water savings can displace most of the oil used in buildings. Superwindows that retain heat in winter and reject it in summer could save each year up to twice as much fuel as we get from Alaska.

In all, we know how to run the present U.S. economy on one-fifth the oil we are now using, and the cost of saving each barrel would be less than $5. Even achieving just 15 percent of that potential oil saving would displace all the oil we've been importing from the Gulf. Doing that requires only a small additional step. Since 1973, we've reduced our oil use per dollar of gross national product four and a half times as much as we'd need to reduce it today in order to eliminate all Gulf imports.

How can we promote fuel efficiency? Higher gasoline taxes are a weak incentive to buy an efficient car, because gasoline costs five times less than the non-fuel costs of owning and running a car. And since the often higher purchase price of an efficient car roughly cancels out the lower gasoline bills, the total cost per mile for 20- and 60-mile-per-gallon cars is about the same.

Graph 2

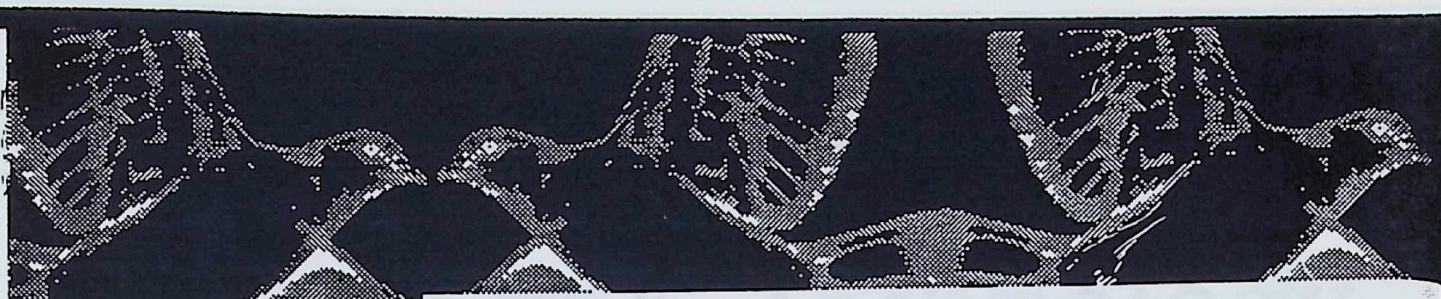
More Efficient Cars — The Key to National Oil Savings



SOURCE — RMI CALCULATION FROM DATA IN DOE/EIA-0035(90/07)

But the 40-mile-per-gallon difference, for cars and light trucks, represents more than twice America's imports from the Gulf. If the security and environmental costs of inefficient cars had to

Did we put our kids in tanks because we didn't put them in efficient cars? The answer is yes.



be paid up front, buyers would choose more wisely. The best way is "feebates": when you register a new car, you pay a fee or get a rebate; which and how big depends on its efficiency. The fees pay for the rebates.

Rebates for efficient cars should ideally be based on the difference in efficiency between your new car and the old one — which you'd scrap, thus getting the most inefficient, dirtiest cars off the road first. That's good for Detroit, for the poor (who disproportionately own such cars and served in the Gulf forces), for the environment, and for displacing Gulf oil sooner.

The California legislature recently approved car feebates by a margin of seven to one (outgoing governor George Deukmejian vetoed the bill, but his successor, Pete Wilson, is expected to sign it later this year). Connecticut, Iowa, Massachusetts, and several other states are weighing feebates. Feebates are also being considered for new buildings in California, Massachusetts, Iowa, and the four northwest states, and could be applied to trucks, aircraft, appliances, and other energy-consuming goods. Unlike miles-per-gallon standards, feebates reward maximum performance and encourage businesses to bring superefficient models to market quickly. Standards *plus* feebates are better still.

Despite military victories, if we continue on our present energy course, no good long-term outcome — in dollars, oil, or blood — is in sight.

Energy efficiency is also the key to the decades-long transition to nondepleting, uninterruptible energy sources. Government studies confirm that sun, wind, water, geothermal heat, and farm and forestry wastes can cost-effectively provide, within forty years, 50 to 70 percent as much energy as America uses today. Efficiency would raise that share and buy the time needed for graceful conversion.

As we have seen in recent months, the military alternative to efficiency isn't cheap. Gulf jitters added more than $40 billion a year to U.S. oil imports. Counting military costs, Gulf oil in late 1990 cost over $100 a barrel.

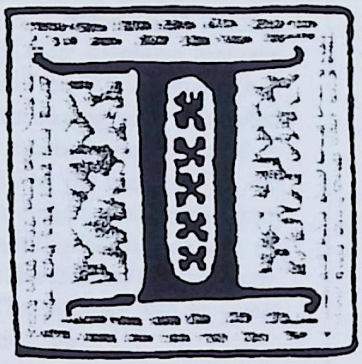
The more than $20 billion net cost of U.S. forces in the Gulf just from August through December 1990, if spent instead on efficient use of oil, could displace all the oil now imported from the Gulf. It could also create jobs and wealth, improve America's trade balance, stretch domestic reserves, clean urban air, cut acid rain and global warming, and help the poor at home and abroad.

In 1989, the Pentagon used about 38 percent as much oil as the U.S. imported from Saudi Arabia, and estimated that its consumption would double or triple in a war. An M-1 tank gets 0.58 miles per gallon. An oil-fired aircraft carrier gets 17 feet per gallon. Despite military victories, if we continue on our present energy course, no good long-term outcome — in dollars, oil, or blood — is in sight.

From inside an efficient car, however, the Gulf looks very different. From inside enough of them, its oil becomes irrelevant.

If, each year for the next ten, America invested as much money in energy efficiency as it spent each week waging the Gulf war, by the turn of the century we would be well on our way to achieving sustainable energy independence — something we have not had for the past twenty-five years. National security, peacetime jobs in a competitive economy, and the environment demand immediate mobilization — not of tanks but of efficient cars, not of B-52s but of 777s, and not of naval guns but of caulking guns. ❦

Privacy & Technology



BY GARY T. MARX

IN THE UNITED STATES we recently celebrated the two-hundredth anniversary of the Constitution, a document that extended liberty. Unfortunately, the bicentenary of another important document that restricted liberty has gone virtually unnoticed — the 1791 publication of Jeremy Bentham's *Panopticon; or, the Inspection House.*

Bentham offered a plan for the perfect prison, in which there would be constant inspection of both prisoners and keepers. His ideas helped give rise to the maximum-security prison. Recent developments in telecommunications, along with other new means of collecting personal information, give Bentham's image of the panopticon great contemporary significance.

The stark situation of the maximum-security prison can help us understand societal developments. Many of the kinds of controls and information-gathering techniques found in prison specifically and the criminal justice system more broadly are diffusing into our culture. We may well be on the road to becoming a "maximum-security society." Such a society is transparent and porous. Information leakage has become rampant; indeed, it is hemorrhaging. Barriers and boundaries — be they distance, darkness, time, walls, windows, or even skin — that have been fundamental to our conceptions of privacy, liberty, and individuality are giving way.

In such a society, actions, feelings, thoughts, pasts, and even futures are made visible — often without the individual's will or knowledge. The line between the public and the private is being obliterated; we are under constant observation, everything goes on permanent record, and much of what we say, do, and even feel may be known and recorded by others whom we do not know — whether we will this or not and even whether we know about it or not. Data in many different forms and coming from widely separated geographical areas, organizations, and time periods can be merged and analyzed easily.

As the technology becomes ever more penetrating and intrusive, it becomes possible to gather information with laserlike specificity and spongelike absorbency. If we visualize the information-gathering process as a kind of fishing net, then the net's mesh has become finer and the net wider.

Just as free association led to discovery of the unconscious, new techniques reveal bits of reality that were previously hidden or contained no informational clues. When their privacy is invaded, people are in a sense turned inside out, and what was previously invisible and meaningless is made tangible and significant.

It is easy to get carried away with science-fiction fantasies about things that might happen. But we need not wait for the widespread use of videophones, paperless electronic safety-deposit boxes, wafer-thin portable personal communications devices, satellite monitoring of individuals via implanted transmitters, or DNA fingerprinting and other forms of biometric monitoring to note profound changes in the ease of gathering personal information. Consider the following:

A college student secretly videotaped sexual encounters with a girlfriend. After breaking up with her, he played the tape for members of his fraternity. She learned of this and was victorious in a civil lawsuit, although no criminal statute had been violated.

Teachers in a school lounge were complaining about their principal,

Gary T. Marx is a professor of sociology at M.I.T. His latest book is* Undercover: Police Surveillance in America *(University of California Press, 1988). This piece is excerpted from a longer article published in* The World and I, *September 1990.
—Howard Rheingold

when one jokingly said, "Be careful, the room might be bugged." Just then they spotted a transmitter in the ceiling, which in fact had been hidden there by the principal.

During a toy manufacturer's television ad, a clown asked children to place their telephone receivers in front of the TV. The studio then broadcast dialing tones that called an 800 number, which resulted in kids dialing the number. The 800 number called had automatic number identification service and recorded the children's phone numbers. The purpose was to create marketing lists.

A friend went on vacation. On returning he had only one message on his answering machine. Shortly after his departure, a synthesized voice "interviewer" had called to ask if he would consent to being interviewed. Since he did not hang up, the system assumed he had agreed to be interviewed and proceeded to ask him a series of questions, pausing after each to let him answer. The interview consumed the full length of the answering machine's tape. In several cases citizens have won lawsuits because during an emergency, an automated dialer had captured their line and could not be disconnected, making it impossible to dial 911.

In Iowa, a woman overheard a neighbor's cordless-phone conversation on her FM radio. She was suspicious of the call and informed police. They instructed her to continue to listen and to record his conversations, all without a warrant, which she did for more than a year. The Supreme Court has ruled that such eavesdropping is permissible.

A variety of personal communication devices, such as cordless and cellular phones and room monitors for infants, can be intercepted easily (and often legally) by scanners, FM radios, and older TV sets with UHF channels. Cordless phones using the same frequency may also pick up wireless communication. Speakerphones may amplify communication. A conversant can never be sure who is listening. In a recent example President Bush was unaware that his off-the-cuff remarks were overheard by a large audience listening in via a speakerphone.

The line between the public and the private is being obliterated; we are under constant observation, everything goes on permanent record, and much of what we say, do, and even feel may be known and recorded by others whom we do not know — whether we will this or not and even whether we know about it or not.

Work monitoring has been taken to new heights, or depths, depending on your point of view. Quantity of keystroke activity, number of errors and corrections, speed of work, and time away from the computer can be measured. Programs such as CTRL and SPY permit remote secret monitoring of a target's personal computer use when his terminal is attached to a larger system. A permanent record of the intercepted terminal's input and output can be made. There is also the possibility of "initial screen repaint," which permits the watcher to see what was on the target's screen before the SPY program was activated. The headsets used by telephone reservationists can be converted to microphones to permit remote monitoring of all office conversation by a supervisor many floors, or even miles, away.

Home phones can be made "hot on the hook": An "infinity transmitter," whether attached to a telephone or part of an answering machine, converts the phone into a microphone. The individual who dials in (the phone does not ring) is able to listen to what is being said in the room.

The US commissioner of immigration has proposed a nationwide computer system to verify the identities of all job applicants. An FBI advisory board recently recommended putting the names of those suspected of (but not arrested for) crimes into a nationally accessible database, as well as the names of the friends and associates of known criminals. The director of the FBI rejected the proposal. Yet pressures to create such national databases are strong.

Marketing researchers are gathering ever more detailed data and carrying out increasingly fine-grained analysis. For example, supermarkets use the itemized bills made possible by bar coding to collect unprecedented information about consumers. Such information (when combined with the personal data consumers provide for checkcashing privileges) is easy to analyze and sell. There is often more to mailed promotional coupons than meets the eye — "invisible" personal data (name, address and other demographic information) may be in the bar code or elsewhere. The behavior of customers who agree to use "frequent shopper cards" is monitored closely, and it will be possible to market directly to households, using

coupons to steer them toward products with higher profit margins. Consumer behavior also can be linked to exposure to specific ads seen on cable television. Persons on the same block watching the same channel may receive different versions of the ad being tested.

Lotus Corporation proposed a new product called "Marketplace," to be available at retail software stores. Its database contained information such as name, address, age, gender, marital status, and estimates of income, lifestyle, and buying habits of 80 million households. The 120 million consumers contained in the database were not asked if they wished to have their personal transactional information treated as a commodity; they would not have been compensated for its sale, nor could corrections easily have been made. The product was withdrawn after massive public protest.

It is easy to imagine how marketing lists might be misused. Purchasers of pregnancy-testing kits may receive solicitations from pro- and anti-abortion groups, or from sellers of birth-control products and diaper services. Purchasers of weight-loss products or participants in diet programs may be targeted for promotional offers from sellers of candy, cookies and ice cream, or, conversely, those whose purchases of the latter exceed the average may receive offers for weight-loss products and services. Subscribers to gay and lesbian publications may be targeted by religious and therapeutic organizations, or face employment denials, harassment, and even blackmail. Frequent travelers and those with multiple residences may receive solicitations from sellers of home-security products, and such lists would be a boon to sophisticated burglars. A list of tobacco users might be of interest to potential employers and insurance companies. A list of those with credit troubles and excessive indebtedness would certainly be of interest to promoters of scams that promise to help people obtain credit cards or get out of debt. A cynic might even hypothesize that such a list would be used by promoters of alcoholic beverages, sweepstakes advertising, and gambling junkets.

THE PREVIOUS EXAMPLES raise a variety of troubling issues: injustice, intrusion, denial of due process, absence of informed consent, deception, manipulation, errors, harassment, misuse of property, and lessened autonomy. But running through most of the examples is the central issue of privacy, as it relates to the control of personal information.

Given these examples and potential problems, it is not surprising that in 1989 half the population thought new laws were needed to protect personal privacy. Yet in a country fascinated by technology, committed to free enterprise and freedom of speech, and concerned over declining productivity, AIDS, crime, drugs, and terror, there are also contrary voices.

Those unconcerned about privacy remind us that we live in an open society that believes that visibility in government brings accountability. With respect to individuals, a valued legacy of the 1960s is personal openness and honesty. The only people who worry about privacy are those who have something to hide. Right?

A response to privacy concerns, expressed by some industry spokespersons, columnists, and citizens, is simply, "So what? Why worry?" In their view, these technologies fill deeply felt needs. A host of arguments is offered to bolster their position: We increasingly live in a world of strangers, rather than in homogeneous rural communities where all residents know each other. The Supreme Court in the *Katz* decision has said that privacy was protected only when it could be reasonably expected. Technology changes and social expectations can't remain static. With more powerful technologies we can reasonably expect less and less, and hence privacy must become more restricted. After all, they say, most so-called privacy invasions are not illegal, and given the free market, one can buy technologies to prevent privacy invasion. For that matter, personal information is just a commodity, to be sold like any other. Companies have an obligation to stockholders to make money. Protecting privacy is expensive and can deter innovation.

Consumers, too, are demanding personalized and customized services. Mass marketing is inefficient, and economic viability requires the "pinpoint" or "segmented" marketing that computer analysis now makes

possible by using "point-of-sale" information. It is up to government to use whatever means it can to be more efficient and to find the guilty and protect the innocent.

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T HAS BEEN SAID that a civilization's nature can be seen in how it treats its prisoners; it might also be seen in how it treats personal privacy.

Noting the social functions of privacy certainly is not to deny that privacy taken to an extreme can be harmful. Nor should the right to privacy infringe on other important values, such as the public's right to know and the First Amendment guarantees.

Unlimited privacy is hardly an unlimited good. It can shield irresponsible behavior — protecting child- and spouse-abusers, unsafe drivers, and money-launderers. Taken too far, it destroys community. Without appropriate limitations it can trigger backlash, as citizens engage in unregulated self-help and direct action. The private subversion of public life carries dangers, as does the public intrusion into private life.

Contemporary information-extractive technologies can, of course, protect liberty, privacy, and security. Without the incriminating tapes secretly recorded by President Nixon, Watergate would have remained a case of breaking and entering; without the Xerox machine, the Pentagon Papers might never have reached the public; and without the backup computer records kept in NSC files that Oliver North thought he had erased, we would know far less about the Iran-Contra affair. Aerial surveillance can monitor compliance with pollution standards and help verify arms-control treaties. Tiny transmitters can help locate lost children or hikers caught in an avalanche. Devices that permit firefighters to see through smoke may save lives, and remote health monitors can protect the elderly living alone (in one type, an alarm is sent if a day goes by without the refrigerator being opened).

But elements of Greek tragedy are present: the technology's unique power is also its tragic flaw. What serves can also destroy, absent increased public awareness and new public policies.

An important example of the kind of principles and policies needed is the Code of Fair Information developed in 1973 for the U.S. Department of Health, Education, and Welfare. The code involves five principles:

- There must be no personal-data recordkeeping whose very existence is secret.
- There must be a way for a person to find out what information about him is in a record and how it is being used.
- There must be a way for a person to prevent information about himself that was obtained for one purpose from being used or made available for other purposes without his consent.
- There must be a way for a person to correct or amend a record of identifiable information about himself.
- Any organization creating, maintaining, using, or disseminating records of identifiable personal data must assure the reliability of the data for their intended use and must take precautions to prevent misuses of the data.

These ideas might be built upon. Ways to do so include establishing a principle of *minimization*, such that only information directly relevant to the task at hand is gathered; a principle of *restoration*, such that in a communications-monopoly context, those altering the privacy status quo should bear the cost of restoring it; a *safety net* or *equity* principle, such that a minimum threshold of privacy is available to all; a principle of *timeliness*, such that data are expected to be current and information that is no longer timely should be destroyed; a principle of *joint ownership of transactional data*, such that both parties to a data-creating transaction must agree to any subsequent use of the data and must share in any gains from its sale; a principle of *consistency*, such that broad ideals rather than specific characteristics of a technology determine privacy protection; and a principle of *redress*, such that those subject to privacy invasions have adequate mechanisms for discovering and being compensated for violations.

T IS NOT a foregone conclusion that developing technology will reduce the power of the individual relative to large organizations and the state, although the forces favoring this outcome tend to be stronger than those opposing it. Schools and religious organizations should deal more directly with the individual's rights with respect to means such as third-party records, computer dossiers, drug testing, and the polygraph. It is important that citizens react to invasions of privacy by questioning organizations, rejecting assertions such as "the computer says" or "that is the policy." Why is it the policy? What moral and legal assumptions underlie it? What alternatives are there? How were the data gathered? How are they protected and used?

It is also important that the technology be demystified and that citizens not attribute to it nonexistent powers. There is a chilling danger in the myth of surveillance, and when tech-

nologies are revealed to be less powerful than authorities claim, legitimacy declines. There should be truth in communications policies, just as we have truth in advertising and loan policies. The potentials and limits of the technology must be understood.

There should be truth in communications policies, just as we have truth in advertising and loan policies. The potentials and limits of the technology must be understood.

There are a number of steps that individuals can take to protect privacy:

• Don't give out any more information than is necessary. You are legally required to give out your social-security number in only a few instances. Don't answer questions that seem irrelevant to the issue at hand. (For example, you may refuse to give your phone number when making a credit-card purchase, or family and income information when filling out a warranty card.)

• Don't say things over a cellular or cordless phone or baby monitor that you would mind having overheard by strangers.

• Ask your bank to sign an agreement that it will not release information about your accounts to anyone lacking legal authorization. It should state that in the event of legal authorization, the bank will notify you within two days.

• Obtain copies of your credit, health, and other records and check for accuracy and currency. You are entitled to know what is in many records and, if you dispute the information, to add your version. Credit records can be obtained from TRW, Equifax, and Trans Union. Medical records can be obtained from the Medical Information Bureau (a databank maintained by 800 insurance companies), Box 105, Essex Station, Boston, MA 02112.

• If you are refused credit, a job, a loan, or an apartment, ask why. There may be a file with inaccurate, incomplete, or irrelevant information.

• If you think you are being investigated by a federal agency or believe the agency has a file on you, submit a Freedom of Information Act request asking to see the file.

• If you think your telephone is tapped or a bug is being used and you find evidence of eavesdropping equipment, contact the police and an attorney. Make use of technologies that can protect your privacy, such as an answering machine.

• Realize that when you respond to telephone or door-to-door surveys, the information will go into a databank. The only federal survey that most persons are legally obliged to answer is the U.S. Census.

• When you purchase a product or service and file a warranty card or participate in rebate or inventive programs, your name may well be sold to a mailing-list company. Ask that it not be circulated.

The Privacy Protection Act of 1974 refers primarily to actions at the federal level and tends to exclude state, local, and private-sector activities. A major failing of the Privacy Act is weak-to-nonexistent discovery and enforcement mechanisms. It is unrealistic to expect most individuals to discover violations, given the hidden and complex nature of much data collection and exchange. The means of locating violations and enforcing standards needs to be strengthened. However, the Office of Management and Budget has given this task a low priority.

The Fair Credit Reporting Act offers no recovery if a consumer is hurt by a technically accurate but misleading report. It is important that there be provision for injunctive relief for damages for persons who suffer intangible harm as a result of privacy invasion and that incentives be created that will increase compliance with the legislation we do have.

Unlike many European countries, the United States does not attempt to regulate data collection. Most protections pertain to how data are treated once they are collected. The First Amendment and concern over creating another regulatory bureaucracy partly explain this situation, but as a consequence, citizens are on their own in discovering and bringing action when their rights are violated and data collectors are given a free hand in gathering information. Given the low visibility of many violations and citizens' lack of knowledge of their rights, laws here are underenforced.

A variety of new federal, state, and local initiatives are needed. Among the promising federal legislation introduced, though not passed, as of 1990 are a bill to extend the protections of the Fair Credit Reporting Act to tenant-screening services; a bill to require a periodic audible beep on phones being monitored; a bill to extend the warrant protection of aural surveillance to video; and a bill to eliminate single-party-consent eavesdropping (a major loophole) so that all parties to a recorded conversation would have to agree.

While the Constitution has implications for privacy in a number of places (in the First, Third, Fourth, Fifth, and Fourteenth Amendments, among others), there is no explicit amendment guaranteeing privacy. States such as California

and Pennsylvania have such protections. The United States might emulate countries such as Switzerland, Sweden, Italy, and Portugal by drafting a constitutional amendment protecting privacy. The challenge is to draft it in a general enough way to protect what needs to be protected, without creating a statute whose vagueness shelters things the public interest requires to be revealed. That such a law might be largely symbolic would not detract from its significance.

With respect to information-gathering technology, we are now in the twilight zone that Justice William O. Douglas wrote about in arguing that the protection of our basic values is not self-executing:

"As nightfall does not come at once, neither does oppression. In both instances, there is a twilight when everything remains seemingly unchanged. And it is in such twilight that we all must be most aware of change in the air — however slight — lest we become unwitting victims of the darkness. One could as well argue that we are in a sunrise zone, and that we must be aware of change in the air in order to insure that we all profit from the sunshine. But for this to happen the technology must be bounded by increased public awareness, responsible corporate and government behavior, and new laws and policies." ❦

From Satori to Silicon Valley

Theodore Roszak, the man who coined the word and the idea "counterculture," has come out with an eloquently written, tightly argued little book that brings together the counterculture of the sixties with the cyberculture of the seventies and eighties. Originally delivered as the 1985 Fine Lecture at San Francisco State University, ***From Satori to Silicon Valley*** *has all the advantages of an oral presentation: not too long, not freighted with dozens of footnotes, yet offering a clear vision of what ties together the psychedelic and visionary impulses of the Haight-Ashbury and the high-tech thrust of computer culture. Anyone interested in the genesis of Bay Area visionary culture and/or computers should read this book. If you're an uncritical flagwaver for the digital revolution, be forewarned: though not as devastating as Roszak's* ***Cult of Information****, this book paints a somber picture of what became of hippie and hacker ideals as the world of international business absorbed them into its vastly older and more powerful domains. In the struggle between what Roszak calls the "reversionaries" — back to nature and the organic way, down with the military-industrial complex! — and the "technophiles" — better living through chemistry and the digital solution to world problems! — one side won and the other lost. We are living with the consequences of these victories and defeats right now, and will be for years to come.*

—Arthur Chandler

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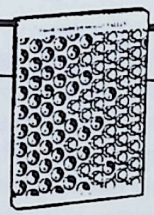
It was an attractive hope that the high technology of our society might be wrested from the grip of benighted forces and used to restore us to an idyllic natural state. And for a brief moment — while the music swelled, and the lights flashed, and the dope cast its spell — it looked like the road forward to many bright spirits. But ultimately — and really in very short order — the synthesis crumbled, and the technophiliac values of the counterculture won out. They are, after all, the values of the mainstream and the commanding heights, forces that have proved far more tenacious than most members of the counterculture guessed.



From Satori to Silicon Valley
Theodore Roszak, 1986; 60 pp.
$3.95 ($5 postpaid) from Lexikos Publishing, P. O. Box 296, Lagunitas, CA 94938; 415/488-0401
(or Whole Earth Access)

Tough Questions • Student Pugwash USA

In 1957, Albert Einstein and Bertrand Russell called upon the world's scientists and citizens to "learn to think in a new way." To that end, a conference was held in Pugwash, Nova Scotia, bringing together academics and policy advisers to propose ways to curb the nuclear arms race. Student Pugwash USA (SPUSA) draws its inspiration from the Pugwash Conferences. Where the original Pugwash Conferences concentrated on nuclear weapons, SPUSA takes a broader view, providing high-school and university students and recent graduates with educational programs organized around understanding the social and ethical implications of technology. ***Tough Questions*** *is SPUSA's quarterly publication.*

—Howard Rheingold

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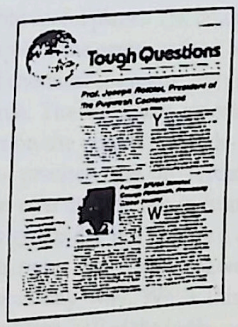
Student Pugwash USA programs address the fact that science and technology are shaping the world in increasingly profound ways. We recognize that if society is to avoid thoughtless applications of technology in the future, it is first critical to train young people to consider the implications of their decisions. Scientists and engineers should be educated about the effects their work will have on society, while policy makers should be prepared to analyze and shape the course of technology policy. Perhaps most importantly, citizens — both young and old — must feel that they have a right and a responsibility to join with experts in addressing the world's most pressing problems.



Tough Questions
Free from Student Pugwash USA, 1638 R Street NW/Suite 32, Washington, DC 20009-6446; 202/328-6555

Genes, Genius, And Genocide

BY JASON CLAY

THE LAST GREAT RESOURCE RUSH HAS BEGUN. It's not land, minerals, timber, or water that are at stake. This time, it's genes, and how to use them. The most genetically diverse areas of the world are inhabited by indigenous peoples. Their areas, and their knowledge, are once again being mined — for information. Unless indigenous rights to this material and knowledge are respected, this gene rush will leave indigenous people in the same hole as the other resource rushes.

Modern technology's relentless consumption of the Developing World is producing one interesting side effect: a belated and growing respect for native cultures. Hollywood makes Indians the good guys in Dances With Wolves. *Archaeological officialdom evolves beyond grave-robbers with Ph.D.s, and museums actually begin to give bones and artifacts back to the tribes they were taken from. But what about the living, what about tribal cultures that understand and preserve entire ecosystems by virtue of having learned how to live in them sustainably? Do they have rights to the useful things found in their world once those things leave it?*

Jason Clay argues that they should. He is the marketing director of Cultural Survival Enterprises, an attempt to create an ethical middleman for marketing sustainably harvested nontimber rainforest products to First World consumers. This article ran as an editorial in Cultural Survival Quarterly. *For information or a subscription, contact Cultural Survival, Inc., 53A Church Street, Cambridge, MA 02138; 617/495-2562.*
—Richard Nilsen

The genetic materials in question make up the building blocks of life. The advent of genetic engineering has intensified the search for genes that can be used to make existing food crops hardier or more nutritious, and for new, more advanced foods and medicines.

Indigenous residents hold the keys to these remote, biologically diverse areas. Their knowledge is the genius that unlocks the genes, often shortcutting decades of costly research and experimentation.

Genetic diversity and local knowledge about its useful properties will pave the way for all humans to adapt to changing circumstances. This is why maintaining the world's genetic diversity and recognizing those who are most familiar with interpreting it are so important. However, this gene rush, merely the latest in a series of assaults on the Earth's resources, will not help biological diversity.

The destruction of the world's biological diversity is related as much, if not more, to poverty as it is to greed. The current rush to discover genetic resources shows no signs of alleviating poverty. The fundamental question is, Who rightfully owns the wide variety of genetic materials currently in demand? Ownership and wealth go hand in hand: if you own something, you can sell it to generate income.

Ownership is an extremely complicated issue, however. Rights to genetic material should depend, to some extent at least, on having knowledge of, maintaining, and manipulating it. Here are a few examples.

If an indigenous group has created a compound of two or more plants that produces known and predictable pharmacological effects, then that group should have as many rights to its discovery — even though it may have taken generations to perfect — as would any scientist or research team in any university or corporate lab.

Likewise, if, over the centuries, a group has used a plant for a specific purpose and has selected it for specific properties, thereby changing the plant from its wild state through such use, then that group should have rights to the "new" plant.

These rights — the more obvious rights that indigenous people should have — are not respected, much less guaranteed, anywhere in the world today. Missionaries working with an indigenous group in western Brazil are reported to have recently taken a sample of an arrow poison compound made by the group and given it to botanists who were conducting inventories of possibly useful plants. The botanists then passed a sample of the arrow poison on to a large, US-based chemical company, the supporter of their research. The company reportedly took out a patent on the poison's muscle-relaxant properties — precisely the properties that made the poison effective for use in hunting. The indigenous group did not receive a cent of royalties, and its rights to the material were not acknowledged in any way. While this "transfer" was taking place, half of the indigenous group's land was seized by the Brazilian government. Patenting the group's knowledge neither benefited the group nor protected the region's biological diversity.

There are other, even grayer areas where indigenous people should arguably have rights to their resources. Under British law, for example, one can make the case that people have rights to materials that they have allowed to flourish, even if they have never utilized them.

By extension, then, indigenous people, in maintaining the world's rainforests and other fragile ecosystems, have rights to any resources discovered there. As the logic of the argument goes, if the groups had not served as guardians of the resource base, it would have disappeared long ago. In this light it would be difficult for any Third World state to stake a claim to the rights of genetic resources existing within its borders. Most of these states (e.g., Brazil, Ethiopia, Malaysia) have done everything they can to develop the resources to death.

This is not to deny other parties' legitimate claims or rights to genetic knowledge. Scientists, corporations, and states alike can incur considerable costs in bringing new materials onto the market. To date, however, indigenous people's rights to either the basic raw materials or to the knowledge that often unlocks their use has been consistently denied. This imbalance must change.

The 1990s have already seen the rise of nationalism and the assertion of local, group control over resources. Genetic material and knowledge are certain to become part of these resources. If we are serious about our desire to protect the world's most fragile ecosystems and most endangered peoples, then we must ensure that these groups be allowed — both legally and economically — to continue to protect fragile areas, as they have done for generations. ❦

THE destruction of the world's biological diversity is related as much, if not more, to poverty as it is to greed.

Rush to Burn

Garbage piling up into mountains as landfills close. Landfills leaking toxins into the groundwater. Oceans burping disgusting glop onto beaches. This magazine usually refrains from reviewing cries of outrage and despair well served elsewhere. But the garbage problem has proven to be uniquely intractable to easy solutions. Some people — including certain environmentalists — think one answer is to burn the stuff, which can have the added advantage of replacing fossil fuel to make steam for the turbines of electrical generating plants. That strategy is a typical example of a "technological fix" for problems rooted in technology. But is burning a good idea? For one thing, it actually gives value to garbage — the more the better.

What to do? The idealistic "make less garbage" and recycling have so far not done much good. The only long-term answers mean major changes across our entire society, and others around the world. It may well be that the garbage problem will spur the first major battle between Earth-trashers and Earth-stewards — metaphorically the first unhidable skirmish of world war III. This multifaceted book uses a wonderful mix of real-life examples to show that we are at last forced to more rigorous standards of honesty, regardless of political expediency. Strong stuff. —J. Baldwin

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Jorie MacKinnon offers a prophetic warning. "Without question, anything that you just don't want to know about is going to come back and get you."

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When Oyster Bay's landfill closed in 1986, it shipped its garbage 160 miles to the Scranton, Pennsylvania, area. A year later, it was forced to go as far as the woodlands of southern Michigan, 635 miles away, and the bluegrass hills of western Kentucky, an 850-mile odyssey, to find landfills that would take Long Island trash.

To cut costs at those distances, East Coast haulers are shipping out garbage on interstate trucks that come from the Midwest carrying consumer products, including foodstuffs, and are looking for a load for the return trip.

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There are no laws to prevent the hauling of garbage in refrigerated trucks or other rigs that haul food products. Several health experts warned that, even with steam-cleaning of the trailers, this practice might spread disease and should be stopped, at least until sanitary tests can be carried out.

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Consultants have become such a big part of the world of garbage that, when western Suffolk's Multi-Town Solid Waste Management Authority closed down in 1983 without building an incinerator, its books revealed that it had spent $8 million for little more than advice and public relations.

Rush to Burn
(Solving America's Garbage Crisis?)
Newsday staff, 1989; 269 pp.
$14.95 ($17.95 postpaid) from Island Press, Box 7, Covelo, CA 95428; 800/828-1302 (or Whole Earth Access)

These are only the most recent demonstrations of a fact of municipal life: Private enterprise and public works make a profitable combination — especially when politics plays a role. A *Newsday* computer tabulation found that most of the major commercial contributors to the Nassau County Republican Party over the last few years have been resource recovery contractors, ranging from engineers to electricians.

Because incineration has become their business, resource recovery engineers tend to inform and advise their clients in ways that promote the industry.

FIGURE & GROUND

Information Technology and the Economic Marginalization of Women

ALL TECHNOLOGIES HAVE HAD ILL EFFECTS. EVEN INFORMATION TECHNOLOGIES.

Take the Press, for example. Everyone likes the press. It spread learning, literacy, science, the birth of capitalism, wealth, the birth of learning, the Enlightenment, the Renaissance.

Women, however, have never recovered the equality lost in the Renaissance.

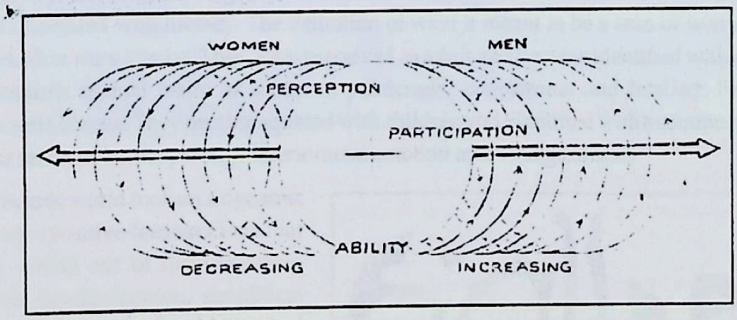
Male/female, mind/body, exterior/interior, public/private, left brain/right brain, mathematical/verbal, business/home, science/art — all comfortable cliches of necessary opposites. Opposites that are applied to gender as if they were biological, as if they were intrinsic.

But consider pre-press Europe.

Before the press and the spread of literacy, domestic and income-producing tasks were like figure and ground of an illustration, each depending on the other. The family was a productive, as well as a reproductive, unit. There was no business/home distinction.

Among the lower classes, a craftsman's wife was the second in command, so that if he died the unit could continue. In the guilds, widows took over the voting rights of their husbands. The vote belonged to the unit; the husband was the agent for the whole. Women belonged to guilds, ran and worked at every kind of enterprise.

A journeyman became a master by marrying a woman from his guild without whom he could not run his business. Apprentices and journeymen did domestic tasks as well as producing goods for sale. Men and women participated in the care and training of children as a normal part of the supervision of the household. The household was the focus and the foundation of the economy. Master and mistress, journeymen, apprentices, serving wenches and children lived, worked, ate, and slept in common concern for the welfare of the whole. There was no public/private distinction. There was little adult/child distinction.



As women do not participate they are perceived as not having ability, as they are perceived as not having ability they are kept from participation, as they are kept from participation they do not have experience of participation, as they do not have experience they become incapable, etc.

The reverse is true for men.

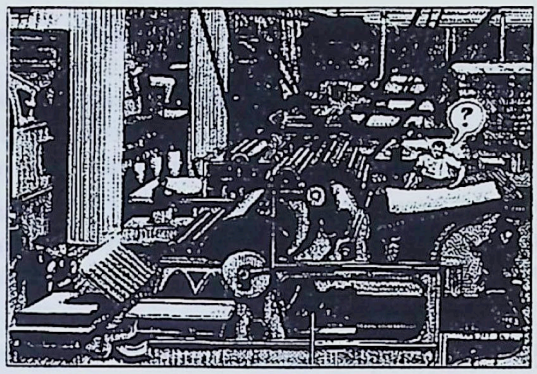
In an unstable world this made great sense. If times were hard they all ate more bread. If times were good they all ate more meat and drank better wine. And at all times they all worked.

Among the upper classes, women of the manor supervised the production of livestock, dairy products, spinning, weaving, sewing, and the marketing and storage of all surplus goods. Enterprising women increased their income by expanding the workrooms under their supervision and selling the finished goods in town.

Among the elite, information and education were available to women whose families could pay for tutors. Spain and Italy continued the Muslim tradition of women mathematicians, astronomers, philosophers, doctors and poets in their universities. Germany had women professors and scholars. In France there was an entire class of Jewish women doctors, many trained at a large private medical school conducted by Sarah of St. Giles.

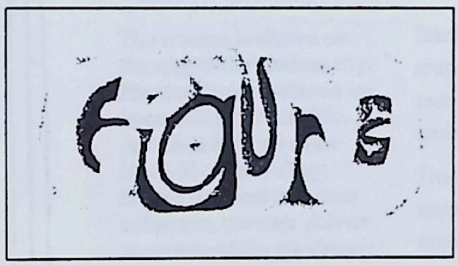
The press brought literacy and bookkeeping methods to the common people and changed the face of society. It emphasized some aspects of life at the expense of others, the way adding more ink to the word "figure" makes the word "ground" less visible.

Once people could keep track of the amount of material they needed and the amount of product they sold, it became apparent that some tasks were more lucrative than others. Maintaining a journeyman to swill the pigs or mind the baby didn't pay. Counting made it possible to plan and contracts made the future more secure. The flexibility of the common table and the common household became less necessary.



Tasks related to production of goods for sale emerged from the background of household activities. Domestic tasks became less visible as attention and resources went into production of goods for sale. The notion of labor became associated with tasks done for money. Business moved from the common room to a room of its own, to a floor of its own, to a separate building. With each move women became more and more identified with the background, the back quarters, the home — the beginning of distinctions such as business/home, public/private, exterior/interior.

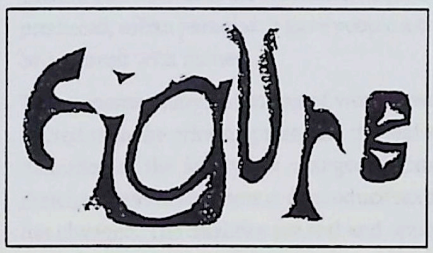
The social world was divided up in a new way. Before the press, it was divided horizontally, by class. Information and education belonged to the elite. After the press, the world was divided vertically, by gender. More men of all classes had access to information. If they could use it to their advantage they could be socially and economically mobile. Women had little access to information and education, and their economic and social mobility depended on marriage.



The press emphasized and enlarged the slight differences that had existed, so both men and women were caught in deviation-amplifying (positive) feedback loops; over time their life experiences spiraled away in opposite directions.

Children and childhood emerged as different and separate from adults as adulthood became associated with literacy. The definition of what it meant to be a man or woman changed. Men were literate. They were perceived as adult and became identified with an individualistic mental realm of business, publicness, exteriorness and intellect. Few women were literate. They became equated with children and identified with a communal physical realm of home, privacy, interiorness, emotion and biologicalness.

The economic world took on a dynamic of its own: a positive-feedback loop that created wealth out of manufacturing based on standardization, simplification and replication — ideas that emerged with the press, whose standard movable type turned out exact duplicates time after time.

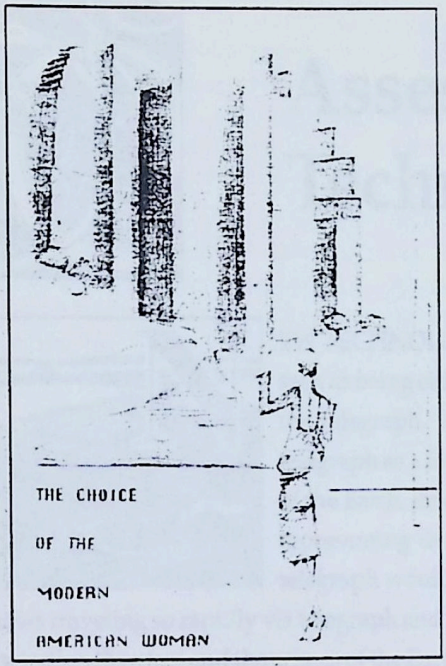


Over time, more goods were manufactured and more people had disposable income. This income became the source of more wealth. Markets expanded and so did the size and diversity of the economic sector, the sector associated with and run by men. Women and children participated as underlings. They worked in the sweatshops and mills, as more and more of what a family wanted was to be had for cash rather than made at home.

Still, until the middle of the last century, most women had important economic roles and many had independent sources of income. Most people lived on farms. Farm women had their egg- and butter-money or money from selling garden produce and handicrafts. All

Eli Whitney (the inventor of interchangeable parts) wrote to the Secretary of War: "One of my primary objects is to form the tools so that the tools themselves shall fashion the work and give to every part its just proportion — which when once accomplished will give expedition, uniformity, and exactness to the whole. . . . In short, the tools which I contemplate are similar to an engraving on copper plate from which may be taken a great number of impressions perceptibly alike."

BY ELIN WHITNEY-SMITH



The woman is shown on the way to the modern city. Physically she is shown as impossibly tall and thin, yet she is held up as an ideal. She is standing lower than, and therefore subject to, the city. Advertisements of the era show men standing above the city in a position of dominance. The window symbolizes light, and the road freedom. Pictures of the bad woman or bad man are shown in rooms without windows.

women made important economic contributions to the welfare of the family. They made and maintained the family's clothes and prepared, preserved and stored food. Most business was still family business — small, local manufacturing or craft shops in small towns. The dream of social mobility was the dream of a family business.

The railroad, the telegraph, then the telephone freed business from geographic constraints and revolutionized how business was done. These technologies completed the economic marginalization of women started by the press.

The press had helped the tasks related to production to emerge from the background of other household activities, like figure from ground. Use of electronic communications technology helped tasks related to command and control to emerge from the background of business ownership. Before electronic communications, the business hierarchy, like the military hierarchy, was based on class: all noncommissioned personnel take orders from all officers, and an officer is still an officer and a gentleman.

Starting in the communication industry, then spreading throughout the economy, people realized communication was more effective if the channel was dedicated and specialized. They applied the engineering notion as a general principle to business management. The new managerial hierarchy was a communications structure. Workers only had to take orders from *their* managers. Because it was suddenly not a social hierarchy, managers did not have to be members of the family that owned the business. This changed the definition of social mobility, and a new class of salaried, professional managers emerged.

These career managers had an interest in the growth and stability of business as an entity instead of business solely as a source of income for the owners. Some realized that management itself could be standardized and the techniques could be applied in many settings. Eventually this led to the corporate structure we know today. To keep the business sector expanding, it was important that as many things as possible be manufactured. This was another positive feedback loop which emphasized man as breadwinner and deemphasized woman as breadmaker.

The pump that kept this feedback loop moving was advertising. Advertising may not always have sold individual products well, but it did a great job of selling the American Dream. The woman in the illustration is looking up the road to a modern, technologically produced, urban paradise. It gave people a criterion for happiness and told them it could be achieved with money.

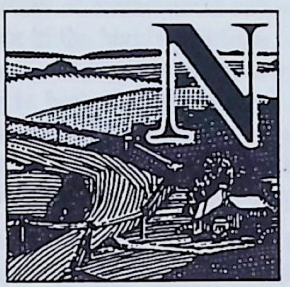
The economic marginalization of women was complete, finishing the process that had started with the printing press, and the real world had become the economic world. The definition of the family has changed. Women who used to produce everything from thatched roofs to beer now only produce sex and children. The entire definition of gender has changed. The dualities are real and oppressive and much of it is due to information technology.

Yet we can't blame the technology as an evil monster, nor can we blame men as oppressors, or women as participants in victimization. We can't even blame the existing social context. There are no villains and there are no easy answers in this story. The best we can do as we question technology is to realize how the figure/ground dynamics emphasize some relationships at the expense of others, in a way that amplifies small differences in starting conditions quickly, by the gears and ratchets of technological power. ❦

Elin Whitney-Smith's last contribution to* WER *was "Information Doesn't Want" (#72, p. 38). Her email address is elin@well.sf.ca.us from any Internet site. —Howard Rheingold

Assessing the Impacts of Technology

BY D. LINDA GARCIA



NEW TECHNOLOGIES are rarely viewed from a position of neutrality. Instead, they are seen as being either the means of mankind's salvation or the cause of its demise. Consider the telegraph. With its power to overcome distance, and hence time, some saw the telegraph as a form of universal communication that would "bind together all the nations of the Earth, link men by a single mind, and give preponderance of power to the nations representing the highest elements of humanity." In contrast, others predicted that the telegraph would lead to cultural decline. As one social observer of the time noted, with news traveling so rapidly via telegraph and being so readily available, the individual would be "entertained with the swindler, the vices and the crimes of the Earth; his paper [would immerse] him in all sorts of things and can only cease to pain him by hardening his heart and taking off the edge of his conscience." *

Linda Garcia is a project director and senior analyst at the Office of Technology Assessment, a research arm of the US Congress. In her fifteen years at OTA, she has worked on assessments having to do with transportation, radioactive waste, and acid rain. As a member of the Telecommunications and Computer Technologies Program, she has worked in the areas of information technology and education, human resources for information-technology R&D, and information policy. She served as project director for the OTA assessments Intellectual Property Rights in an Age of Electronics and Information; Critical Connections: Communication for the Future; *and the recently released* Rural America at the Crossroads: Networking for the Future.
—Howard Rheingold

With the debate thus cast between technophiles and Luddites, there is little room for a middle ground. Both sides are heavily armed. Each can draw on any number of examples to substantiate its position. But the problem of understanding technology remains unresolved in the heat of the argument; few stop to sort out, or even to consider, the circumstances under which technology can work for or against society. It is this kind of assessment that policymakers must have if they are to make sound decisions about technology development and deployment.

The Office of Technology Assessment undertakes such assessments. OTA is a research arm of the Congress, much like the Congressional Research Service, the General Accounting Office, and the Congressional Budget Office. To distinguish OTA from its sister agencies, and to understand its mission, one needs to look at its history, and the circumstances under which it came to life.

OTA was created in 1972, with the passage of the Technology Assessment Act. This was a time of considerable domestic turmoil; there was growing disillusionment with many established institutions, public and private. Part of this disillusionment grew from our problems in Vietnam; but it also reflected our growing awareness of some negative aspects of technology. During the early sixties, Rachel Carson had published *Silent Spring*, describing the harmful effects of DDT. And in the mid-sixties, Ralph Nader had first told Americans that their cars were unsafe.

We also discovered that technological impacts might be extended and experienced over time and space. We learned, for example, that to understand the consequences of using DDT, we would have to trace its effects through more than one generation of the plants and animals with which it had come into contact. And we found that sulfur dioxide, even if it were generated by coal-fired utility plants in our Midwest, could travel as far as Canada, and, in the process, be transformed into acid rain.

Given this growing number of technological issues, and an increased awareness of their complexity, Congress decided that it needed more and better information about how new technologies might affect society. Rather than relying on other institutions to provide this information, Congress wanted its own source of information, independent of the executive and judicial branches of government.

* Daniel Czitrom, *Media and the American Mind* (Chapel Hill, NC: The University of North Carolina Press, 1989).

OTA was created to look at the long-term impact of technology on society. This does not mean that we were to take a position on technology. Rather, we were to try to anticipate technological consequences, so that we might avoid or ameliorate the negative impacts while still enjoying the benefits.

OTA's success has been in its ability to balance the political and the analytical. OTA has carried out objective research and analysis of a number of controversial subjects while operating in the highly politicized congressional arena. Being able to operate simultaneously in both the political and research arenas means that our studies are generally relevant to the issues at hand, and that they are likely to have an important policy impact.

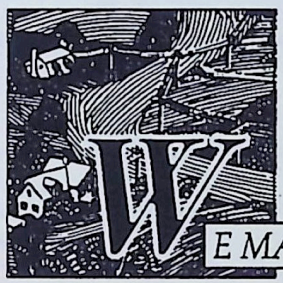
Speaking about my own particular program at OTA, the Telecommunications and Computer Technology Program, I can point to a number of recent cases where our studies have significantly affected the outcome of the congressional debate. The policy conclusions from our study on electronic surveillance were used as the basis of a new privacy law. And our study concerning the impact of technology on intellectual property rights broadened and fundamentally restructured the national discussion of the issues.

Because the US political system is based on the separation of powers, there is room for OTA to play a truly independent (albeit political) role. Under this system, where there are a number of "independent commissions" staffed by the executive branch but accountable to Congress, OTA is a thoroughly legitimate and acceptable way of organizing policy research.

OTA's organizational structure helps it to maintain this delicate balance between research and politics. OTA is, first of all, a nonpartisan agency. It is governed by the Technology Assessment Board, a bipartisan, bicameral body made up of six members from both the House and the Senate, who represent both parties equally. This board rules on and approves OTA studies at their outset and at their conclusion.

Unlike the Congressional Research Service, which responds to requests from individual congressmen, OTA works only for committees, which are themselves bipartisan. Typically a requesting committee will ask us to do a study. The appropriate program within OTA will then develop a proposal which, after internal review, will be submitted to the Technology Assessment Board for approval. The board will also review the final draft of the report; upon approval by the board, a study's findings are released to the public.

OTA's research method reflects its unique role. Many federal agencies seek information and get feedback by holding hearings, calling for comments in the Federal *Register*, and undertaking inquiries. The information thus generated is then collated and synthesized in government reports. Presumably the sum of these public comments equals the "public interest." In my view, this does not constitute research; it is, instead, a literary form of log-rolling. At OTA, we begin by conceptualizing the problem, setting up hypotheses, and developing research questions. This is a more rigorous and objective approach.



This is not to say that we try to avoid outside opinion. We make an effort to seek a representative balance of all points of view. By reaching out to all the players, and incorporating their concerns into our research design and analysis, we create a product that is valued as much for its process as for its substance.

All OTA assessments are supported by an advisory panel, comprising individuals who are knowledgeable in a particular area, or who have a stake in a study's outcome. The panel's job is to provide OTA staff with advice about the scope, methodology, and substance of a study. Members come from business, academia, public-interest groups, and sometimes from the general public. Putting together a good panel, whose members will work well together, is akin to designing a work of art. A balance needs to be struck, not only among interests but also among personalities.

OTA advisory panels take on a life of their own. Panel members rarely agree, either with OTA or among themselves. They debate and argue using OTA draft documents as the basis for discussion. In the process, panel members inform OTA as well as each other.

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The OTA staff's research also benefits from the help of experts. Contractors generally write background papers on subjects that are outside the scope of the staff's expertise. When faced with a unique or particularly thorny research problem, the staff might put together a workshop where experts can come together to discuss the data and sort out the evidence.

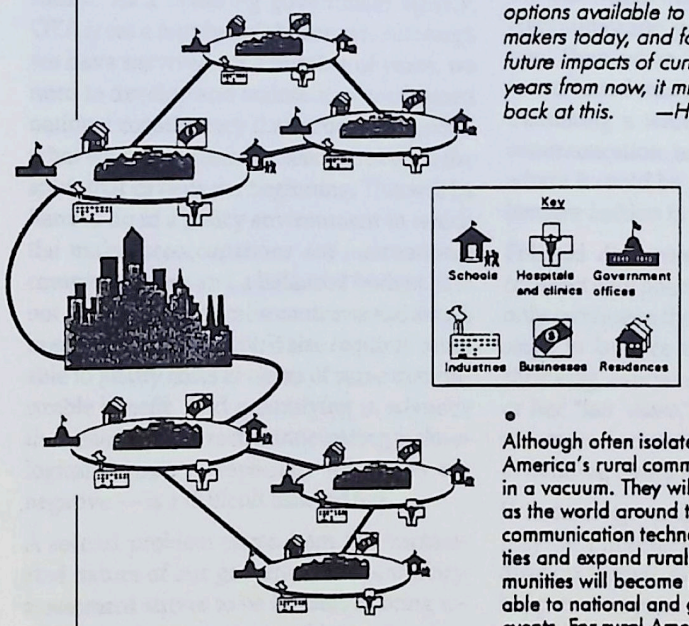
Interested parties also come to speak to us, and their input is always welcome. In fact, I often invite people to "lobby" us. A lobbyist's statement can be turned into a hypothesis: "If Government would only do . . ., then . . . would happen." This is a perfect "if/then" statement, and an excellent source of research questions.

OTA studies also reach out to the public. For example, as part of our study *Intellectual Property Rights in an Age of Electronics and Information*, we conducted a number of focus groups and a public-opinion survey to gain a better understanding of the ethics involved in copying. Since young people are major users of electronic products, we also held a workshop of junior-high and high-school students. We wanted to find out what the general public considered to be "fair." This was a critical piece of information for us. We could not suggest changes in intellectual property laws unless we had a good idea of how enforceable they might be.

Our recent study *Rural America at the Crossroads: Networking for the Future* took us out into the field. We did not believe we could study rural development without trying to

Rural America at the Crossroads

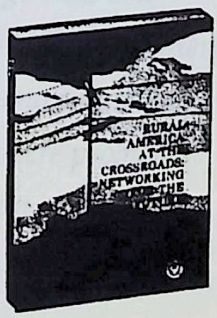
Linda Garcia was the project director of OTA's recent assessment of the impact of communication technologies on rural America. This document lays out the options available to citizens and policymakers today, and forecasts the possible future impacts of current decisions. Ten years from now, it might be useful to look back at this. —*Howard Rheingold*



A Rural Area Network would be designed to foster the deployment of advanced technology to rural areas in an economically viable manner by pooling the communication needs of a community's many users — especially the businesses, educational institutions, health providers, and local government offices.

Although often isolated and remote, America's rural communities do not exist in a vacuum. They will inevitably change as the world around them changes. As communication technologies extend rural ties and expand rural markets, these communities will become increasingly vulnerable to national and global trends and events. For rural America, the most critical of these developments will be the adjustment to a highly competitive, service-based, global economy and the emergence of major, worldwide environmental concerns that will compel them to reorient their economies. Since many rural communities lack essential financial and human resources, and often depend on a single industry for the lion's share of their wealth and vitality, their ability to adapt to these changes is limited. Without some form of intervention, these communities are headed for decline.

Advanced communication and information technologies are certainly not "the" solution to the many problems confronting rural America. In fact, one needs only to look historically to see examples where the deployment of these technologies has left rural communities worse off. However, in the current economic environment, in which businesses are using these technologies strategically to gain a competitive advantage, communities and businesses that have limited access to them are unlikely to survive. While not a panacea, in a global, information-based economy, these technologies could help rural communities overcome a number of the barriers that have limited their economic well-being in the past.



Rural America at the Crossroads
Serial # 052-003-01228-6. 1991; 190 pp.
$9.50 postpaid from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9325; 202/783-3238

understand the people, their cultures, their environment, their problems, and their hopes and aspirations. And we knew we had to visit more than one place. Although rural communities share a number of values, the way these values enter their social and political discourse varies greatly. For this reason, we chose to visit four states: Kentucky, New Mexico, Washington, and Maine. We selected them for geographic balance, ethnic and economic diversity, and contrasting approaches to the development of the telecommunications infrastructure. In each state, we visited economic-development professionals, telephone-company representatives, politicians and activists, educators and academics, businesspeople, and "ordinary" citizens. With the four members of our project staff traveling together for a week at a time, processing our experiences as we went along, continually debating our findings, we were able to develop a new way of thinking about telecommunications and rural economic development.

Our record of success does not assure our future. As a maturing government agency, OTA faces a number of challenges. Although we have survived for a number of years, we need to develop and maintain a broad-based national constituency that strongly supports what we do. In effect, we need to rekindle the spirit that gave us our beginning. This will be hard to do in a policy environment in which the major preoccupations are international competitiveness and a balanced budget. It is not only difficult to raise controversial issues in such an environment; it also requires being able to justify costs in terms of some demonstrable benefit. And quantifying in advance the benefits of correctly anticipating technological impacts — especially when they are negative — is a difficult task indeed.

A second problem stems from the fractionated nature of our government. Technology assessment strives to be holistic, to bring together a wide assortment of interrelated issues. Yet in a country where power is divided among a number of agencies and institutions, there is no single locus where problems can be dealt with comprehensively. Even in Congress, issues are broken up on a committee-by-committee basis. And concerns about turf, more often than not, preclude real cooperative joint action.

This problem is nowhere exhibited more clearly than in the area of communication policy. In the United States, responsibility for communication policy is highly fragmented. A number of agencies have a say in such matters, including the National Telecommunication and Information Administration (housed in the executive branch within the Department of Commerce), the FCC (an independent agency responsible to Congress), the Department of Justice, Judge Greene and the 1st Circuit Court of the District of Columbia (responsible for administering the Modified Final Judgment that broke up the Bell telephone system into the Regional Bell Operating Companies), the National Institute for Standards and Technology, the Department of State, and the House and Senate Commerce Committees together with their respective telecommunications subcommittees. In this environment, it is no wonder that we have been unable to establish any communication policy, much less a holistic one. Thus, when OTA recently completed a broad-based study on communication policy examining a wide range of interconnected communication issues, there was no place where it could be "received" in the comprehensive fashion in which it was written.

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Political divisiveness, and its tendency to constrict how policy issues are conceived, can only increase in the future, as we take further steps to balance the budget. With the pie shrinking, everyone begins to clamor for his or her "fair share." And there will be more money and resources for those who succeed in defining issues narrowly.

If technology assessment is to continue to play an important policy role, it needs to develop further as a discipline. For this to happen, everyone needs to be part of the debate. And the discussion needs to be more sophisticated. We need to spend more effort trying to understand the dynamics of technology as it evolves in different social contexts, and less time promoting or denouncing technology itself. Hopefully, discussions such as the one appearing in these pages will further this effort. ❦

Renegotiating Science's Contract

BY HOWARD LEVINE

Howard Levine, unemployed philosopher, is former director of the National Science Foundation's Public Understanding of Science Program. He is the coauthor (with Howard Rheingold) of Talking Tech *(William Morrow, 1983) and* The Cognitive Connection *(Prentice-Hall, 1986), and the author of* Life Choices *(Simon & Schuster, 1987).*
—Howard Rheingold

WHILE no one realized it at the time, it now seems clear that Neil Armstrong's "one small step for [a] man" was also the symbolic top step for the public's perception of science and technology. What has happened to science, the putative religion of twentieth-century *Homo sapiens*? How did it fall from grace so quickly?

The Old Contract

Support for science and technology in the larger society derives from two sorts of beliefs: first, that those intellectual endeavors contribute to the material wellbeing of society; second, that science has intrinsic value in terms of the rational, empirical search after truth for its own sake. During the years immediately after World War II, almost no one was calling these beliefs into question.

In retrospect, science in the 1950s seems dominated by one event — the launching of *Sputnik*. Given the Cold War and fear of the use of space for military purposes, it was natural to be concerned about the threat of Russian space supremacy. In addition to national defense, scientific advancement, through the space race, became an important political tool. It was crucial that the USA and not the USSR be perceived by the rest of the world as the dominant space power.

Another important fact about the space race was its unintrusiveness; it simply did not affect the everyday lives of the general populace. People cared about the success or failure of a space shot because of what it symbolized — national pride and technological preeminence — not because it directly affected their lives. Supporting science and the space program was simply a function of good citizenship.

A third important fact in establishing the social climate for science and technology in the 1950s was NASA's brilliantly orchestrated publicity campaign. Given its series of successes, solid congressional support, informational programs for both children and adults, and judicious use of television, it is not surprising that the general public had an overwhelmingly positive view of science. In fact, this public perception was nearly unanimous. A University of Michigan study published in 1958 showed that only 3 percent of the sample asked disagreed with the statement that "Science is making our lives healthier, easier, and more comfortable." Only 6 percent disagreed with the statement that "One of the best things about science is that it is the main reason for our rapid progress." Perhaps General Electric was poll-watching when it coined the slogan, "Progress is our most important product." Questions about the undesirable side effects of "progress" would not become popular until well after the publication of Rachel Carson's *Silent Spring* (1962).

Given the public's positive and benign view of science and technology in the 1950s, it is not surprising that the implied social contract, or bargain, between science and the larger society was modeled very much on *laissez-faire* principles. According to Gerald Holton, professor of physics and the history of science at Harvard University, the bargain between science and society involved a form of barter. Society expected to receive material benefits in exchange for granting scientists moderate financial support and considerable administrative freedom. Under the conditions of the implied contract, the two parties were distant and disengaged. Each relinquished to the other things that it could well afford to yield or that it did not particularly treasure. Yet the public perception of science was about to change and, along with it, a desire to renegotiate the terms of the contract began to arise.

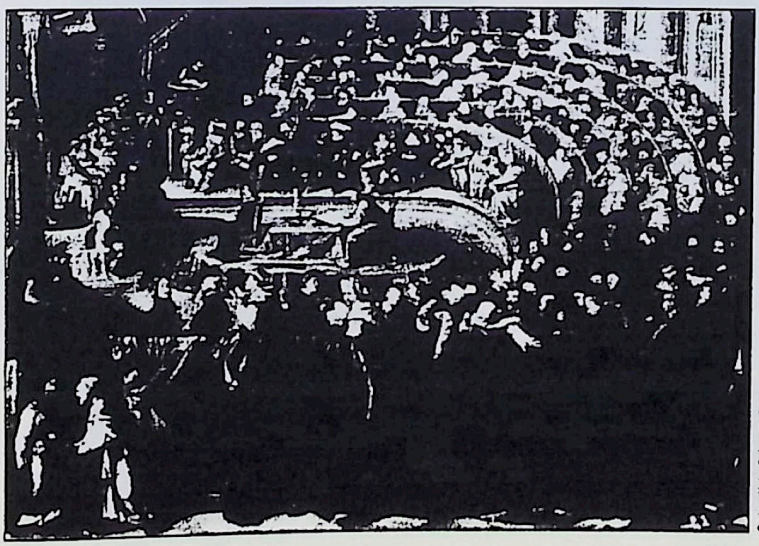
Renegotiation

In every age, the status of science is linked directly to the other interests and institutions of the larger society. There have been periods (e.g., between the two world wars) when that relationship has been stable and the role of science clear. However, there have also been periods such as the early seventeenth century — where the conflict between science and society is best exemplified by the persecution of Galileo — when the role of science has been in dispute. It seems that America is currently in just such a dispute over the value of science in our society. It is not necessarily a loss of confidence in scientists or a decline in the belief that science and technology can help solve many of our problems. It is fundamentally a dispute about how much influence sci-tech should have on our lives and who should be making the decisions governing the extent of that influence.

There is no single reason behind the public's desire to have a greater voice in sci-tech policy formulation. Nor can "the public" be regarded as monolithic either in its concern over particular issues or in its response to each such issue. However, there does seem to be a cluster of five reasons that, taken together, explain the greater part of the public's desire to renegotiate science's contract:

1. *Intrusive Technology* — Whether it's societal anxiety over large-scale, centrally controlled technologies (e.g., nuclear power) or personal concern regarding the nonavailability of desired drugs (e.g., RU486), technology plays a fundamental role in everyone's life. Far from being a test of good citizenship, support for science and technology in the 1990s is usually determined by personal, social, economic, and political considerations.

2. *Undesirable Research* — Although recombinant DNA research receives the



Scientists & Inventors

Sci-tech policy, Inquisition style: Galileo was tried for heresy in 1633 for insisting that the Sun, rather than the Earth, was the center of the universe.

lion's share of the headlines from both those who oppose it on safety grounds (means) and those who oppose it on ethical grounds (ends), many areas of scientific research and practice are undergoing close scrutiny. For example, the growing body of guidelines governing the conduct of experiments regarding animals and human beings, regulation of data-collection activities, concerns about the use of science to excite racial, sexual, or class prejudices, and concern that scientific investigations involving fetal research may have profound moral and ethical implications. Even when safety is not a consideration, the public is beginning to view many areas of scientific research as a Faustian bargain.

3. *The Knowledge Elite* — As scientific and technical knowledge have assumed growing policy importance, so has the decision-making power of independent, specialized bureaucracies such as the Nuclear Regulatory Commission, the White House's Office of Science and Technology Policy, and Congress's Office of Technology Assessment. This use of a "knowledge elite" has tended to insulate sci-tech policymaking from public control. Thus, while sci-tech choices have increasing social impacts, traditional political outlets for consensual decisionmaking play a decreasing role in fostering those policies.

4. *Public Science/Scientists* — There are more scientists alive today than the total number of deceased scientists, and they are not all practicing esoteric, lab-coat science. Many scientists, at organizations such as The Center for Science in the Public Interest or The Union of Concerned Scientists, are concerned with policy issues that have ethical, economic, social, and political components. Yet, as scientists have become advocates, they have surrendered some of their authority derived from the time-honored neutral pursuit of knowledge governed only by the rigors of method. While it is both legitimate and useful for scientists to investigate problems with social implications and to present their own views in light of the evidence gathered, they must realize that this is a role change with severe consequences: closer public scrutiny of methods used for evidence of bias in favor of results obtained. This may be an old political problem, but it is a relatively new one for science and scientists.

Scientists & Inventors

In cases such as the storing of nuclear wastes, certain population groups are asked to bear a substantial risk so that other sectors of society, often in a different political jurisdiction, may benefit.

5. *Big Science* — In 1989, the US spent $132 billion on research and development — about half by government, half by industry. With so much money at stake, the public simply wants to make sure that it is getting what it's paying for. The growing interest in the direction of some funding decisions — AIDS vs. other biomedical research, a few "mega"-projects, supercollider and human-genome *vs.* more and smaller projects, defense *vs.* non-defense spending, and the continued investigations into the peer-review system — provides evidence that the public is no longer sure that scientists and engineers acting alone are the best judges of the most promising areas of scientific and technological activity.

These five reasons are not merely abstractions. They represent real trends as the contract between science and the larger society undergoes its renegotiation. Yet, while it is still too early to envision the completed contract, some of its major clauses are already discernible.

The New Contract

One major clause in the new contract involves responsibility for determining the risk-benefit calculus to be used in cases of technological applications. While it is clear that citizens expect their government to protect them from the potentially reckless decisions of individual entrepreneurs (not to mention the government itself), just how much authority the citizenry is willing to grant to the government is less clear. A major issue in this regard is the extent to which the federal government should issue "uniformity-of-standards decrees" setting maximum and minimum levels of safety which would be binding on state and local governments. It may be generally acceptable for the federal government to preempt local policy in cases in which the risks of technology are global and the sources of those risks difficult to localize or control, such as the effects of fluorocarbons on the ozone layer. A reasonable case for federal standards can also be made where risks, while locally controllable, are evenly distributed — such as in the use of medical x-rays. However, where there is differential rather than global impact, where certain citizens are more greatly affected or more at risk, the case is not so clear.

Should those citizens who live near a nuclear power plant have a right to form their own policy? In cases such as the storing of nuclear wastes, certain population groups are asked to bear a substantial risk so that other sectors of society, often in a different political jurisdiction, may benefit. Is it enough for them to have special participation in the setting of federal policy, or should they be allowed to formulate a local policy? If federal policy is to preempt local policy, should localities that bear a greater risk be compensated? If so, by what criteria should the level of compensation be determined? Finally, there are issues such as the availability of experimental drugs that create conflict between individuals and the State. Who should determine personal levels of safety? Deciding the answers to these questions is a major bargaining point in the renegotiation.

A second clause in the new contract must deal with the mechanisms by which the public is to make its many voices heard. Much of what has passed for public participation in sci-tech decision making in the past has been of the passive type. Accordingly, the public is given a chance to respond to a proposal, or set of guidelines or regulations, only after they have been drawn up by technical experts. The open hearing is the standard mode of this form of public participation, as is solicitation of responses to regulations published in the

Connections

Secular Science

Much has been written in the past twenty years about the public's antiscientific attitude. This appears to be a misinterpretation of the evidence. The public has not turned against science, but toward responsible science. Furthermore, people have perceived that the best way to insure greater responsibility is through their own participation. University of Chicago historian and philosopher of science Stephen Toulmin has described the public's mood in the following way: "A lot of the difficulties that arise about the relations between the scientific community and the rest of society at the present time have important and significant parallels with the medieval problems of relations between church and state. . . . What we're faced with . . . is the Protestant Reformation. What we're faced with is a demand from the rest of society to be let in on the whole system of ecclesiastical courts. . . . I think that the public suspects that the closure of the mechanisms of discussion is, in effect, a way of keeping them from the debate about things that are really their business."

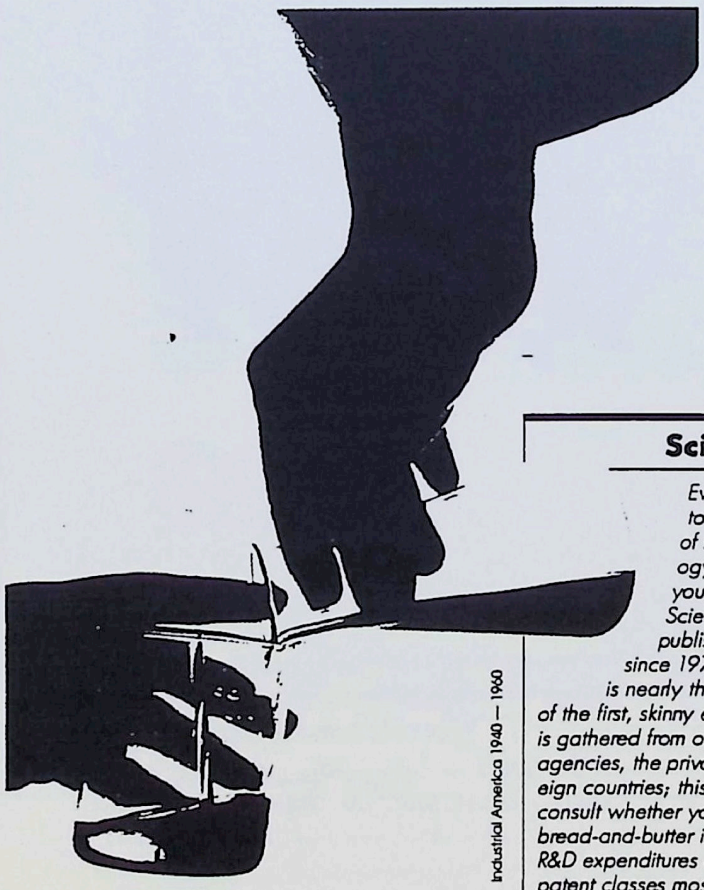
Seen in this light, science's fall from grace should not be interpreted as a sign of absolute disaffection for science. Rather, it is the realization that in our secular society no institution is allowed to exist in a perfect state of grace.

Federal Register. The trouble with this passive mode of participation, however, is that most of the fundamental decisions have already been made by the time the public is asked to react, and subsequent, permitted changes are usually marginal. It should also be obvious that such a system strengthens the power of the "knowledge elite."

The last few years have seen the laying of the foundation for a new, active type of public participation. A number of organizations of scientists and engineers have been formed to provide better scientific and technical information and expertise to nonscientific groups in order to permit them to react more effectively and at earlier stages. The National Science Foundation's Office of Science and Society funds a number of programs designed to facilitate informed interactions between the public, the government, and the scientific community.

Increasing numbers of nonscientists are being appointed as active members of scientific advisory panels and citizen advisory groups. While the desire of affected parties to participate in sci-tech decision making is increasing, that desire often conflicts with efficiency, economy, and the need for special knowledge imposed by complexity. Finding an appropriate balance between democratic participation and expert competence is a major task of the renegotiation.

Certain other clauses are suggested by a number of interesting and timely questions: How can the public achieve a measure of participation regarding sci-tech decisions made in the private sector? How can professional scientists and engineers enter into public policy debates and still maintain an authority based on unbiased knowledge? How can the public be educated in order to be better equipped to help make sci-tech decisions? Ultimately, as Gerald Holton has suggested, the new contract will not much resemble the old. It will involve each side giving up substantial and treasured items. It will also involve much more mutual involvement and understanding. Each side will have to barter away some of its autonomy if it is to obtain important, monitored benefits and assurances. The new contract is much less a revision of the old than it is a document *de novo*.



Industrial America 1940 — 1960

Science & Engineering Indicators — 1989

Everything you wanted to know about the health of science and technology, and a few things you didn't. The National Science Foundation has published nine of these since 1972; this latest volume is nearly three times the size of the first, skinny effort. The information is gathered from other governmental agencies, the private sector, and foreign countries; this is the volume to consult whether you're interested in bread-and-butter issues such as national R&D expenditures or the more arcane — patent classes most and least emphasized by French inventors patenting in the United States: 1978 and 1988. If it's about science and technology, and if our government knows about it, you'll find it here.

Graphs and statistical tables abound.
—Howard Levine

- The decade-long (1975-85) uninterrupted expansion of support for U.S. science and technology (S&T) has leveled off in recent years (1985-89). With some important exceptions, most indicators of U.S. S&T show significant slowdowns and downturns.

- Four other questions repeated from 1957 also reflect broad public feelings about science. Substantial majorities of Americans continue to believe that science is making our lives healthier, easier, and more comfortable (question a) and that science does not break down people's ideas of right and wrong (question c). In both cases, however, there was less support for science in 1988 than in 1957. Apparently, the more negative sentiments actually developed between 1957 and 1979.

PART FOUR:

TECHNOLOGY AND THE FUTURE

The Post-Suburban Metropolis

BY PETER CALTHORPE

The technology of the built environment is easy to criticize and difficult to change, particularly as it relates to our ever-increasing dependence on automobiles. Architect and planner Peter Calthorpe is designing alternatives that are actually getting built. His article "Pedestrian Pockets" appeared in WER *#58 (p. 118), and* The Pedestrian Pocket Book, *to which he contributed, was reviewed in the* Whole Earth Ecolog *(p. 72).*

Calthorpe was recently chosen to create an alternative land-use plan for Portland by the 1000-Friends of Oregon. This influential watchdog group has been responsible for monitoring state legislation setting urban limit lines for Oregon's cities; the task at hand in Portland is to devise transit-oriented development alternatives in hopes of avoiding construction of a proposed perimeter freeway. Calthorpe has also been hired by two of California's fastest-growing counties, Sacramento and San Diego, to develop design guidelines for their new growth areas. His firm, Calthorpe and Associates of San Francisco, has created masterplans for 60,000 acres at sites throughout the US. Among these is Laguna West, a 10,000-person pedestrian pocket currently under construction outside Sacramento. —Richard Nilsen

Walkable Streets: *The scale and character of neighborhood streets must change to provide pedestrian-friendly connections and social places, rather than car-dominated driveways and high-speed collectors. Streets should be tree-lined, with front porches replacing garage doors.*

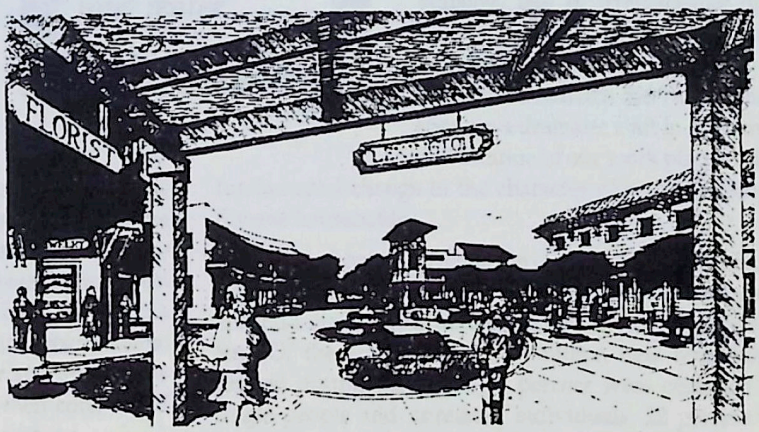
PEOPLE ARGUE ENDLESSLY about growth — where, how much, what type, what density, and if it is really necessary at all. Sprawl is bad, infill is good (if it is not in our neighborhood), new towns destroy open space, masterplanned communities are sterile, and urban redevelopment is fine for "other people." In all cases, we have been doing a terrible job of building our cities, suburbs and new growth areas; our patterns of growth are dysfunctional, regardless of location or type. The problems of growth are not to be solved by limiting its scope or location; they must be solved by rethinking the nature and quality of growth itself, in every context. We need to start creating real neighborhoods rather than subdivisions, urban quarters rather than projects, diverse communities rather than segregated masterplans; quite simply, towns rather than sprawl.

The quality of growth is dependent on the technology of mobility — the mix and interaction of the automotive, mass-transit, and pedestrian worlds. The car is now the defining technology of our built environment. It sets the form of our cities and towns. It dictates the scale of streets, the relationship between buildings, the need for vast parking areas, and the speed at which we experience our environment. Somewhere between convenience and congestion, the auto dominates what were once diverse streets shared by pedestrians, cyclists, trolleys, and the community at large. And more importantly, the auto allows the ultimate segregations in our culture — old from young, home from job and store, rich from poor and owner from renter. It has come to dominate the public realm, extending the private world from garage door to private destination.

As a piece of technology with a mind of its own, perhaps we should ask what the car wants, or for that matter what a transit system or a pedestrian wants. The car in all cases wants to go fast. Speed has many implications on the built environment — it defines a street system with few intersections and many lanes, it requires wide streets with soft sweeping turns, it wants ever more freeways and ever-larger parking areas. These criteria result in the curvacious superblock arterial system, freeway networks, and parking-lot-isolated land uses so common today. The car wants lots of pavement and the low density development that preserves plenty of space for it. The car also seems to want to travel more; between 1969 and 1983 the national population grew by 16 percent while the total vehicle miles traveled in cars increased 56 percent.

The requirements of a transit system are quite different. Its fundamental desire is for more riders. This requires higher-density land uses (housing at ten units per acre minimum), dedicated right-of-ways for easy movement, infrequent station stops (one-mile minimums), frequent service (no more than fifteen-minute intervals) and big, mixed-use job destinations like city cores. Destinations need to be mixed and walkable so that riders are not stranded when they arrive. Some transit systems have modest dreams, wanting only to serve the poor and carless on an infrequent basis at slow speeds. Some are very ambitious, looking for urban densities, high speeds, and uninterrupted underground passageways.

The wants of the pedestrian overlap and in some cases contradict the requirements of these other systems. Pedestrians want close destinations — shops, schools, services, recreation. They want direct links to these destinations free of cul-de-sacs; parking lots, or massive intersections. They want safe, interesting, and comfortable streets to walk on, tree-shaded and with houses and shops fronting directly on them for interest and security. They want detail and human scale in the edges and places of a community. Simply put, they want narrow streets lined with entries and porches



Town Centers: Rather than "strip" retail centers lining arterials, the town center must combine civic functions, small businesses, and stores with parks, plazas, transit stops, and daycare. It must collect the daily activities of a community and be a source of identity for several neighborhoods.

leading to local shops, schools and parks — not rows of garage doors on curving streets leading to six lane arterials. Pedestrians also like transit to extend their range of destinations. These wants can be satisfied in either high-density urban centers or small mixed-use towns. The issue is not one of density but of quality.

Each of these systems places differing demands on the environment and architecture. Clearly the car places the greatest stress on the environment while "liberating" architecture from the limits of urban context and human scale. At the speed of the auto, little more than isolated signature buildings will read — the grotesque landscape of corporate symbols and chain-store logos. Mass transit calls for a more dense, integrated and focused architecture than our current planning models require. The pedestrian wants an architecture oriented to the sidewalk, one that provides continuity as well as diversity, and has human scale and detail.

Various environments satisfy different combinations of these wants. The European city works for both the pedestrian and mass transit, but has great difficulty accommodating the car — hence the many movements throughout Europe to ban the car in old city cores. The traditional American town provided for both the pedestrian and the car (back when there was only one car per household), but rarely offered the density or focus needed by mass transit. The modern American city, violated by urban renewal, suburban flight, parking structures, and freeway interventions, fails to fully satisfy the auto, the pedestrian, or mass transit. The modern suburb pleases only the car, leaving both mass transit and the pedestrian unsatisfied.

THE auto allows the ultimate segregations in our culture — old from young, home from job and store, rich from poor and owner from renter.

Given the social, economic and environmental forces of our time, some new synthesis of these three systems is needed. The challenge is to introduce the needs of the pedestrian and mass transit into the auto-dominated regions of our metropolitan areas, not to return to the fiction of small-town America or hope to absorb a disproportionate percentage of growth into urban centers. Urban centers will grow strong if their suburban areas deliver transit riders rather than cars to their core, and if their internal development favors the pedestrian.

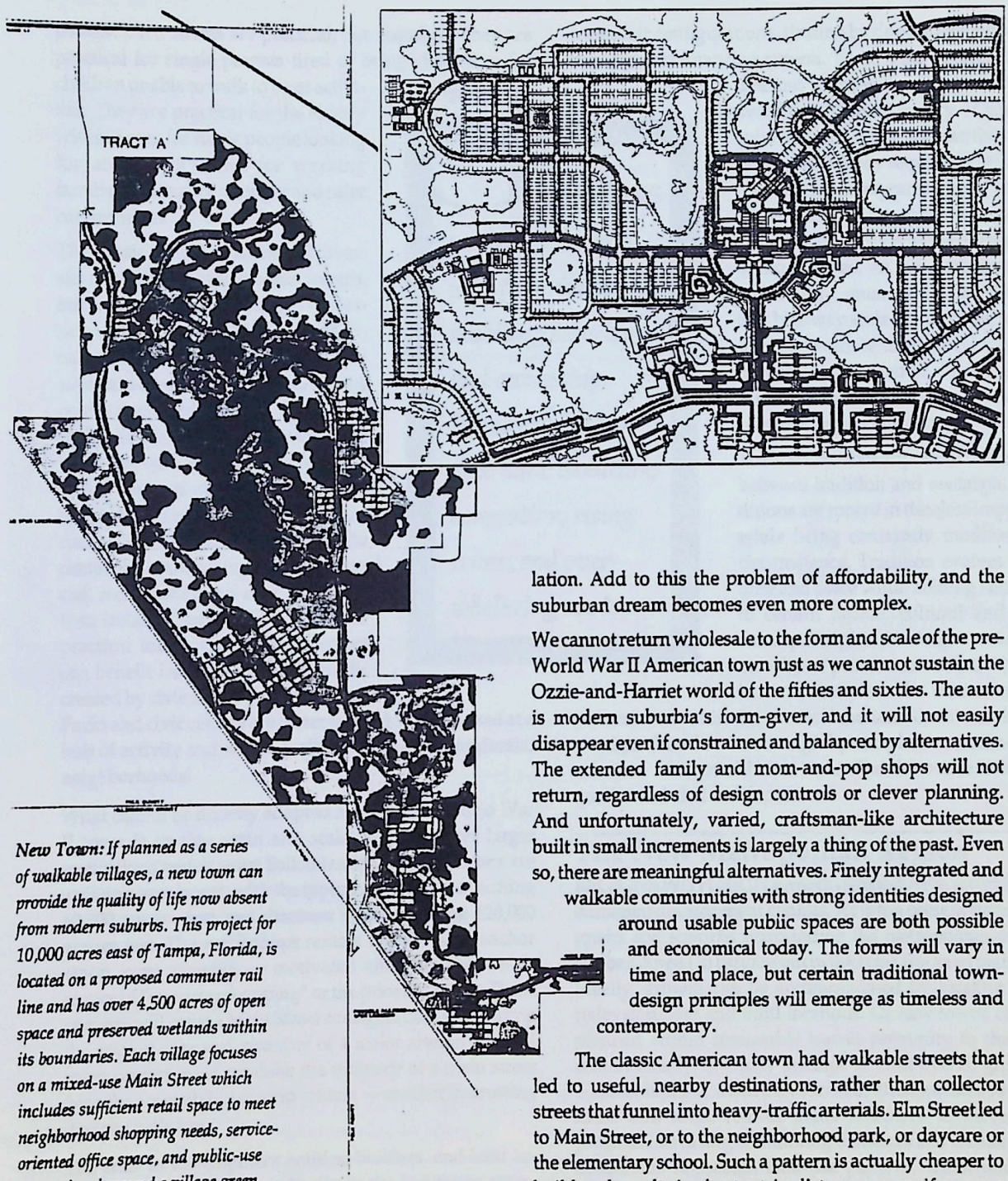
Pockets of mixed-use development with streets designed for both the pedestrian and the car will support expanded mass transit into the suburbs. A network of such developments will provide a focus in the suburban environment. This will draw traffic from the overloaded arterial system and city center, support a transit network, and balance housing and job opportunities within the region. The entire metropolitan framework needs to be layered, with an arterial grid for through auto traffic, neighborhood streets that link homes with local destinations for pedestrians and slow cars, a transit system reinforced by suburban stations with intensified development, and a pedestrian-dominated urban center. Such a metropolitan strategy would simultaneously address environmental, social, and technical concerns, rather than segregating them. It would define a context for an architecture of solutions rather than of anecdotes.

The Crisis of Place in Suburbia

THERE IS A growing sense of frustration and placelessness in our suburban regions, a fractured quality that overlays the unique aspects of each place with chain-store architecture, scaleless office parks, and monotonous subdivisions. Americans moved to the suburbs for privacy, mobility, security, and ownership. Increasingly they now have isolation, congestion, rising crime, and overwhelming costs.

There is a profound mismatch between the old suburban patterns of settlement that have evolved since World War II and the post-industrial culture in which we now find ourselves. This discrepancy is generating environmental stress, intractable traffic congestion, a dearth of affordable housing, loss of irreplaceable open space, and lifestyles that burden working families and isolate the elderly. This mismatch has two primary sources: a dramatic shift in the nature and location of our work places, and a fundamental change in the character of our increasingly diverse households.

A major shift has occurred in the quality and makeup of the American household. Our old suburbs are designed around a stereotypical household which is no longer prevalent. Of the approximately 17 million new households formed during the 1980s, 51 percent were occupied by single people and unrelated individuals, 22 percent by single-parent families, and only 27 percent by married couples with or without children. In the group with children, the family now typically has two workers. People over the age of sixty-five will make up 23 percent of all new households. The traditional three-bedroom, single-family residence is relevant to a decreasing segment of the popu-



New Town: If planned as a series of walkable villages, a new town can provide the quality of life now absent from modern suburbs. This project for 10,000 acres east of Tampa, Florida, is located on a proposed commuter rail line and has over 4,500 acres of open space and preserved wetlands within its boundaries. Each village focuses on a mixed-use Main Street which includes sufficient retail space to meet neighborhood shopping needs, service-oriented office space, and public-use space placed around a village green. This new town would combine 20,000 new homes with 36,000 jobs.

lation. Add to this the problem of affordability, and the suburban dream becomes even more complex.

We cannot return wholesale to the form and scale of the pre-World War II American town just as we cannot sustain the Ozzie-and-Harriet world of the fifties and sixties. The auto is modern suburbia's form-giver, and it will not easily disappear even if constrained and balanced by alternatives. The extended family and mom-and-pop shops will not return, regardless of design controls or clever planning. And unfortunately, varied, craftsman-like architecture built in small increments is largely a thing of the past. Even so, there are meaningful alternatives. Finely integrated and walkable communities with strong identities designed around usable public spaces are both possible and economical today. The forms will vary in time and place, but certain traditional town-design principles will emerge as timeless and contemporary.

The classic American town had walkable streets that led to useful, nearby destinations, rather than collector streets that funnel into heavy-traffic arterials. Elm Street led to Main Street, or to the neighborhood park, or daycare or the elementary school. Such a pattern is actually cheaper to build and results in shorter trip distances, even if cars are used. The streets are narrow, have sidewalks and are tree-lined. They are fronted by porches and entries rather than garage doors and driveways. They allow through traffic but slow it with frequent intersections and frugal dimensions. Gone are the extremes of soundwalled expressways and cul-de-sacs. Privacy is maintained but partly shifted from the front yard to the neighborhood. Security is provided by eyes on the street rather than gates and armed

patrols. Such streets are practical, not nostalgic. They are practical for single parents tired of being chauffeurs for children unable to walk to most activities. They are practical for the elderly without cars, for single people looking for accessibility, and for working families looking for stronger and safer communities.

> *AMERICANS moved to the suburbs for privacy, mobility, security, and ownership. Increasingly they now have isolation, congestion, rising crime, and overwhelming costs.*

The classic American town had diversity of use. So does the modern suburb, but with greater separations. The classic town separated activities: residential streets, commercial streets, school sites, and a formal civic center. But the connections between uses were close, walkable, and direct. (Even our larger cities are use-zoned, with vertical mixed use —in which, for example, a shopkeeper lives above his shop— the exception rather than the rule.) The center of the town integrated commercial, recreational, and civic life rather than isolating them. This is also quite practical today. Commercial centers can benefit from the increased traffic created by civic and recreational trips. Parks and civic centers are better utilized when located at a hub of activity and within walking distance of residential neighborhoods.

What cannot be directly adapted from the pre-World War II town is its fine grain and scale. We now have larger institutions which resist Balkanization. Retail markets are growing ever larger, with the typical supermarket pushing 60,000 square feet and discount stores reaching 120,000 square feet. The small shops remain but the large anchor stores keep growing — motivated either by the convenience of "one-stop shopping" or the price discounts. These anchors will resist a Main Street configuration, demanding the market area and visibility of a major arterial. Hybrid town centers must combine the intimacy of a main street with the accessibility of strip centers — another interesting design challenge.

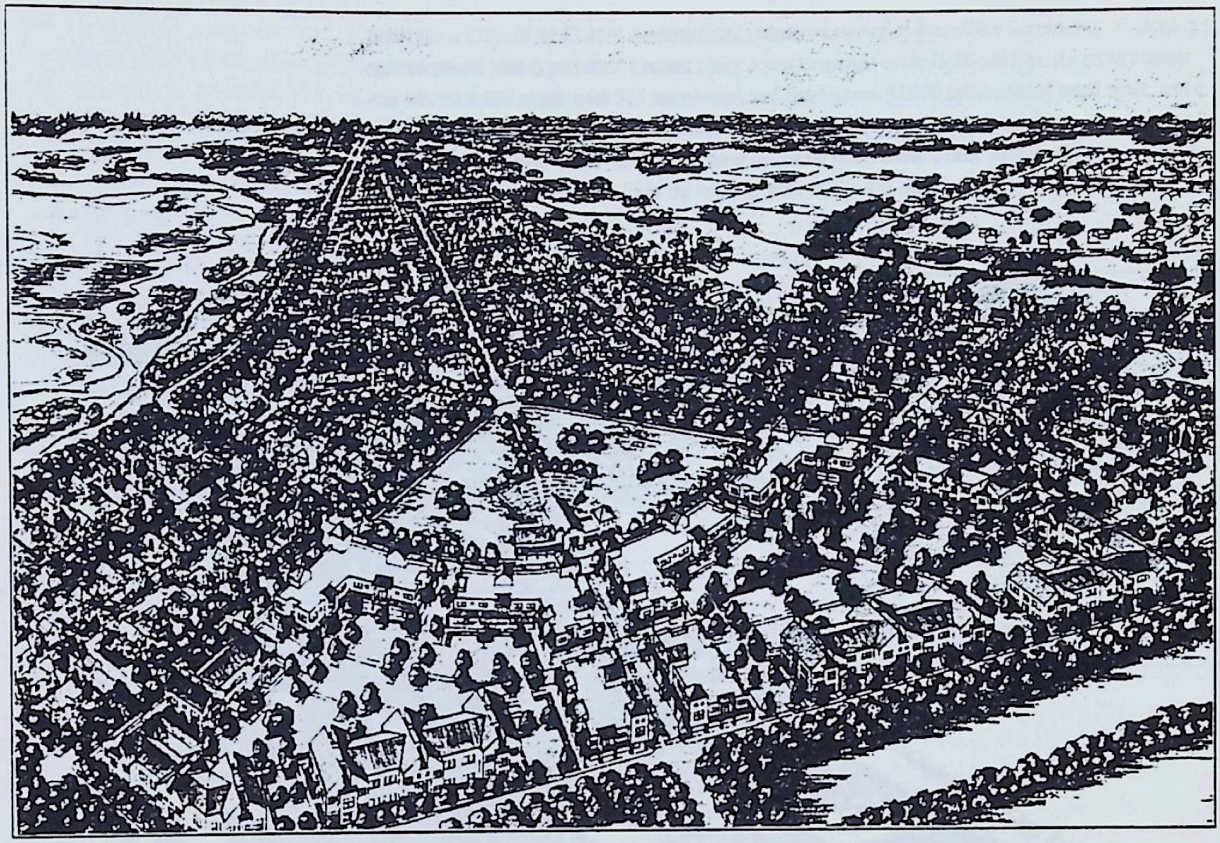
The scale of development entities, builders, and land assembly has also grown radically in the last thirty years. Towns no longer grow by individual buildings or even small groups, but by production units of approximately 150 houses or by retail centers of at least 60,000 square feet. Apartments are rarely developed at under 100 units because of management economics. Land developers often bring over 100 acres (the size of a classic town center) through the permitting process with one masterplan. Rather than the architectural diversity of incremental growth, we are confronted by large blocks developed into formulaic configurations dictated by developer inertia and conservative financing criteria. These huge developments demand innovative design in order to avoid the "theme" quality of isolated subdivisions, shopping centers, and office parks. They require an architecture which integrates them into a larger community without nostalgically imitating the scale and diversity of older towns. At the same time, the architecture must avoid the sterility and highway scale of the modern suburb. The scale of these developments cannot be concealed or denied, but it can contribute to and be made responsive to a larger civic order.

There is a fine but important difference between tradition and nostalgia. Traditions are rooted in timeless impulses while being constantly modified by circumstance. Tradition evolves with time and place while holding strongly to certain formal, cultural and personal principles. Nostalgia seeks the security of past forms without the inherent principles. The current architectural interest in the classic American town can tilt toward profound and meaningful principles or merely color suburbia with an old-time style. The difference is in the quality and skill of adaptation.

The New Metropolitan Region

REGIONS WITH HIGH growth demand have several fundamental development choices. As is the present standard, towns and suburbs surrounding the metropolitan center can be allowed to balloon out in the typical sprawl patterns. Ideally, growth can be accommodated by locating it in redevelopment and infill locations. Or new towns can be planned within reasonable transit proximity to the city center. Finally, one may attempt to limit overall growth. Such limitations, when they succeed, often spread development into more remote areas receptive to piecemeal projects, increasing commuting distances and creating the ubiquitous hopscotch land-use patterns. Unfortunately, the most common strategy is to allow the spread of existing suburbs and towns, resulting in sprawl, traffic, and a loss of identity for what may have been distinct neighborhoods, villages and towns.

Infill and redevelopment should always be a component of any region's growth policy, but to expect such sites to absorb the majority of new development is often unrealistic. The quantity of sites is often too small to accommodate large numbers, and the time needed to develop such sensi-



Edges: New communities should have clearly established edges which form greenbelts around urbanization. These edges should use and respect sensitive habitat, openspace, or agriculture. Each new community should be made distinct by its greenbelt.

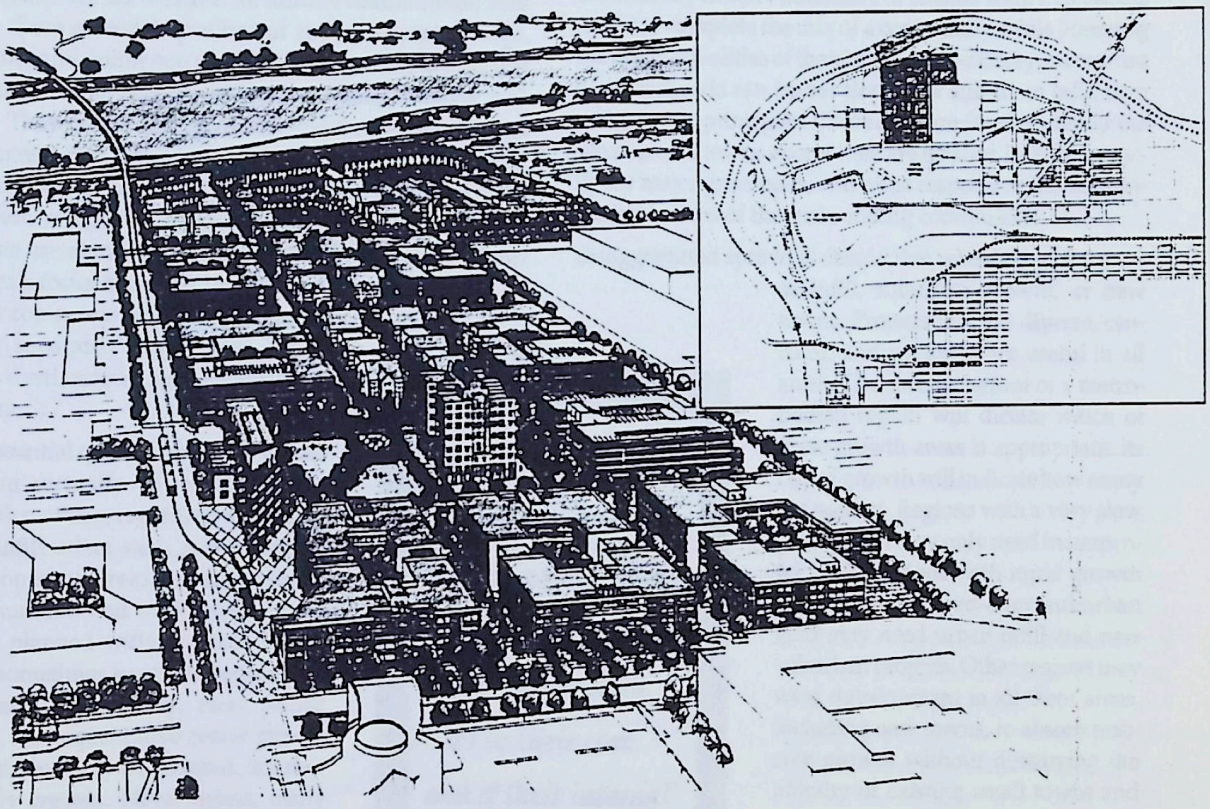
tive sites is sometimes prohibitive. The impact of NIMBYs is also having a profound restraining effect on infill development. We all want infill projects to prevent sprawl, but we rarely support them in our own neighborhood.

If planned well, new towns can help structure a metropolitan region by absorbing growth, supporting transit, and creating greenbelts. If truly transit-oriented, new towns can relieve the regional highway system, improve air quality, and support an often-underutilized rail or bus system. Time after time it has been demonstrated that an effective transit system helps to invigorate the downtown. Portland's new light-rail system has been credited with the phenomenal regeneration of its downtown, bringing both jobs and new retail activity to the urban core. Public transit always focuses on the central business district and delivers people, not cars, to the heart of a city. This reduces the need for parking structures and obviates destructive urban freeway projects. Adding more sprawling suburbs to a metropolitan fringe increases pressure for parking and freeways downtown while it competes with the city for jobs and retail activity. Transit-oriented new towns reinforce the city's role as a region's cultural and economic center.

Greenbelting should always be part of the growth strategy for both new towns and the larger metropolitan region. The two are complementary; a new town can provide greenbelts for the metropolitan area at the same time it buffers its own edges. Failure to use greenbelts with new towns means a fast-growing region will continually expand into the nearby natural edges of open space. Establishing new towns with greenbelts will break the continuous expansion of suburbs.

But modern new towns have a bad name. In Europe, with some notable exceptions, they are sterile and suburban. In America they are sterile, suburban, and (even worse) economic failures for the first twenty years. Are these qualities inherent in new towns, or a result of a dysfunctional design philosophy? After all, our favorite cities and towns were all once new. Is it just time that transforms a new town into a diverse and complex city? Or is it the nature of current economic forces, the technology and sociology of the times,

Infill for a City: In an 51-acre, underutilized industrial section of downtown Sacramento, a mixed-use redevelopment plan is proposed. Located along a new extension of the light-rail line, the project would mix jobs for 6,800 people with 916 townhomes and apartments, 54,000 square feet of retail space, and a hotel. The heart of the project is an "around-the-clock" transit stop that opens onto a major pedestrian plaza lined with retail shops, restaurants, services, and a hotel. Small public plazas and parks are located along the pedestrian spine that links the housing with the transit stop.



and the design of the plan which inhibits or enhances a successful maturation? Certainly the history of planning as it has evolved in this century plays a great role in this question.

At the turn of the century, and again during the Great Depression, the theory of new towns evolved in several directions. Ebenezer Howard and the Garden Cities movement defined a Luddite's vision of small towns, built for workers, surrounded by greenbelts, combining the best of city and country. These towns were sited around rail stations and combined Romantic and Beaux Arts urban traditions with powerful civic spaces surrounded by village-scale neighborhoods. In the same period, Toni Garnier developed the first modernist approach to town planning, segregating industry from housing and freeing buildings from the street. During the Depression, Le Corbusier and Frank Lloyd Wright expanded the vision in both cities and suburbs while retaining fundamental modernist principles — segregation of use, love of the auto, and dominance of private over public space. The street as the habitable common ground of the community began to disappear. Even in the most progressive of the post-World War II new towns, these basic modernist postulates have compromised, if not destroyed, the ability of these areas to evolve into vital urban communities.

It is hard to pin down the difference between suburb and "new town" these days. Suburbs are acting more and more like modernist new towns; they have jobs, retail, recreation, civic services and a diverse population. They also have the placeless quality of most new towns. And when you study

the planning procedures required of suburban "masterplanned communities" and "specific area plans," they resemble intentional new towns in scale, effort, and conception. But they are not *real* towns and probably never will be. Both suburbs and many modern new towns lack the fundamental qualities of real towns — center, edge, integrated diversity, and clear public space.

Pedestrians are the catalysts for healthy communities; they make these essential qualities of towns — center, edge, diversity and public space — meaningful. They are the lost measure of community, setting the scale for center and edge. They create the place and the time for the casual encounters that provide the connections and integration within diverse communities. Without pedestrians a city's common ground — its parks, plazas and sidewalks — become useless obstructions to the car. When this happens, an area's focus can easily be disaggregated commerce and civic functions easily separated into distant chain-store destinations and government centers.

The essential qualities of towns are absent in virtually all contemporary growth patterns, regardless of the context. Infill urban sites, new suburban development areas, masterplanned communities, and new towns all fail when planned without them. Urban infill sometimes succeeds because the qualities of diversity, clear public space, and a qualitative center pre-exist and need only be honored, not necessarily created. Nevertheless, many infill projects succeed in destroying these pre-existing qualities. Modern suburbs and new towns typically lack real centers, definitive edges, or significant public spaces. They have diversity in use and user, but the diverse elements are segregated by the car. They have none of the casual and spontaneous human interaction that creates vital neighborhoods, quarters, or towns.

URBAN centers will grow strong if their suburban areas deliver transit riders rather than cars to their core, and if their internal development favors the pedestrian.

The special qualities of place are easily blurred by the speed and isolation we feel in cars. Although pedestrians will not displace cars anytime soon, their absence in our thinking and planning is the fundamental source of the failures of infill and new growth areas. Plan as if there were pedestrians and we may allow kids, the elderly and others to walk again. Plan for pedestrians and we can transform suburbs into towns, projects into neighborhoods, and networks into communities.

In a sense we should be building towns in all growth areas — infill, suburbs, and satellites. In each context the quality of development should follow the same town-like principles: housing for a diverse population, a full mix of uses, walkable streets, positive public space, integrated civic and commercial centers, transit orientation, and accessible open space. For urban infill, such development can become "new-town-in-town" designs for large parcels, such as Mission Bay in San Francisco. For smaller infill parcels, the task is to complete the mix of a community while honoring the unique qualities of the place. Lower-density, mixed-use neighborhoods can be developed for suburban infill sites with similar principles. These sites are fundamentally the same as new towns except they are smaller, lack the capacity for major greenbelts, and must respond to the idiosyncratic qualities of the surrounding community.

Disaggregated sprawl is destructive wherever it occurs — as infill, suburban growth, or new towns. Projects that are diverse, centered, and walkable are useful in all areas. The specific nature of a metropolitan region will dictate which of these growth areas is appropriate; its rate of growth will indicate how many are needed. Regions with a very slow growth rate may only need incremental infill. Regions with rapid growth and much skipped-over suburban land may need urban infill and new suburban projects. Other regions may need development in all three areas, including new towns, to absorb massive growth without destroying the identity of existing small towns and urban centers. The quality of development we allow, not necessarily its location or size, is the principal problem and opportunity of growth.

These are the design challenges of creating the post-suburban metropolis: to develop a regional growth strategy that uses infill and new growth areas to reinforce transit, community, and social diversity; to create an architecture that reinforces public space without sacrificing the variety and character of individual buildings; to create a planning approach that integrates the pedestrian into mixed-use, livable neighborhoods; to see the environment as an asset rather than a limit to human settlement; and to evolve a design approach that is capable of accommodating modern institutions without sacrificing human scale and memorable places. These are challenges of greater difficulty (and potential grandeur) than the current struggles between environmentalists and developers, between regional interests and neighborhood activists. They are challenges of real consequence. ❦

Coming Soon to a Store Near You: TRANSGENIC PLANTS

BY SIMSON GARFINKEL

MOST FRESH TOMATOES bought in the U.S. today are picked green, packed in crates, and ripen on their way to market. That's because all tomatoes contain polygalacturonase (PG), a natural protein that's the biological equivalent of a self-destruct device. Before tomatoes are ripe enough to make into a hearty sauce, PG is hard at work, literally digesting the tomato from the inside. In the wild, this helps the tomato get its seeds into the ground quickly. But for farmers and grocers, PG is a headache, responsible for countless tomatoes that aren't fit to sell.

The patented "Flavr Savr" tomato is different: it looks like a regular tomato, but it doesn't rot. It's been genetically modified. The DNA for the gene that tells the plant how to make PG has been snipped out, reversed and reinserted with biotechnology's finest scalpel.

Since this new tomato rots very slowly, farmers can leave it to ripen fully on the vine, resulting in a tomato that looks, smells, and tastes better than the majority of today's storebought ones. That spells more profits for grocers, farmers, and Calgene.

Based in Davis, California, Calgene — developer of this brave new tomato — is an eleven-year-old biotech startup company with 300 employees and $35 million in annual sales. The company filed for FDA approval in August 1991; if things go as planned, Calgene's tomato could be on supermarket shelves by 1993.

It is becoming increasingly apparent that the way most Americans will first experience the advancing biotechnology revolution won't be by undergoing a genetic test or by being cured of a disease; it will be by eating food, wearing cotton, or sniffing flowers that have been genetically engineered. Calgene is not the only company pursuing the green gene: according to a recent survey, at least twenty-five U.S. companies are applying recombinant DNA techniques to plant technology. And the products under development sound like an organic farmer's wish list: carrots that taste sweeter; cotton that insects don't eat; vegetables and grains that are immune to viruses — and much more. In the future, engineered plants might be more resistant to drought, impervious to soil salinity, able to fix their own nitrogen from the air, or even have improved photosynthesis capabilities.

Both the scientific community and environmentalists are less scared about the potential dangers of recombinant DNA than they were in the early 1980s. Few believe that, like some 1950s B-grade horror movie, a lone company's genetics experiment will go crazy and become a "superpest," wreaking havoc on an unsuspecting ecosystem. "Some of the forecasts of disasters for biotech organisms were wholly unrealistic," says Dr. Rebecca Goldburg, a scientist with the Environmental Defense Fund. But there are still a few dark corners in the genetically engineered field of the not-too-distant future — dangers

> ***Agribusiness has been breeding tomatoes tough enough to be kicked along the highway to market. Customers complain they don't taste like they used to. Now a biotech company is splicing tomato genes in the hope of improving flavor. Is it food (the Food and Drug Administration is currently pondering this question), and will you buy it?***
>
> ***Simson Garfinkel writes on science and technology issues. He took issue with Eric Drexler's theories about nanotechnology in WER #67 (p. 104).***
> ***—Richard Nilsen***

Calgene's Matt Kramer in a 1990 field trial of the "Flavr Savr" tomato.

The way most Americans will first experience the advancing biotechnology revolution won't be by undergoing a genetic test or by being cured of a disease; it will be by eating food, wearing cotton, or sniffing flowers.

not of something going wrong, but of things going exactly as planned.

One of the most disturbing developments with genetically engineered plants, says Goldburg, is that while most of the companies in the industry spend their time talking about insect and virus resistance, their research dollars go toward developing plants that are resistant to herbicides.

Monsanto, for instance, is in its fourth year of developing a variety of canola (a source of vegetable oil) that is resistant to the company's Round-Up herbicide. Round-Up is an amazingly potent herbicide: by interfering with photosynthesis, it kills everything green. Farmers planting Monsanto's new canola will be able to control weeds by spraying with Round-Up, killing everything but their cash crop.

Round-Up is an ideal herbicide, according to Jim Altemus, a Monsanto spokesman: it isn't very toxic to people and, since it breaks down in contact with soil, it doesn't collect in groundwater. And because Round-Up is so powerful, says Altemus, farmers will have to use it less: "Our whole premise in developing plants that are tolerant to herbicides is that fewer chemicals are going to be in the environment to deal with weeds. Many times the problems will be minor and not require any chemical remediation."

Goldburg and other environmentalists aren't biting. For starters, they say, companies are developing crops that are resistant to pesticides that are much more dangerous than Round-Up. Calgene, says Goldburg, is developing cotton that tolerates bromoxynil, while the Agriculture Research Service in Albany, New York, is now testing potatoes tolerant to 2,4-D. (Round-Up itself isn't that safe: runoff in streams and rivers has been shown to kill aquatic life.) The actual result of herbicide-tolerant plants, say environmentalists, will be strong pressures on farmers to use more herbicides, and use them more often.

Five of the seven largest pesticide manufacturers (Bayer, Ciba-Geigy, ICI, Rhone-Poulenc, and Monsanto) are also ranked among the world's twenty-five largest seed companies; all are using biotechnology to develop herbicide-resistant plants, according to a 1987 article in *Rural Advancement Fund International Communique*. The industry's goal is to profit by selling patented seeds that only work with specific, patented pesticides.

"Are chemical companies going to develop herbicide-tolerant plants so they can sell fewer chemicals?" asks Goldburg.

To make things worse, Goldburg says, your taxes are paying for some of the research though USDA research grants. In 1990, Senator Patrick Leahy, chair of the Senate Agriculture Committee, introduced a bill that would have prohibited the "USDA from funding mission-oriented research to develop herbicide-tolerant plants," says Goldburg. The bill was with-

drawn after pressure from the USDA and industry.

Companies like Monsanto do hope to sell fewer chemicals with their insect-resistant vegetables, cotton and grains. Last summer, Monsanto conducted six outdoor tests of its insect-resistant cotton in Alabama, Mississippi, Louisiana, Arizona, and at two locations in Texas. The tests compared the insect-resistant cotton with cotton protected by a weekly application of conventional insecticide; a third field at each location was left untreated as a control.

In all the trials, the genetically engineered cotton fared as well as the chemically protected plants: less than 8 percent of the cotton bolls on each plant were destroyed, according to Dr. David Fischoff, director of Monsanto's Plant Molecular Biology division. By comparison, between 10 percent and 40 percent of the bolls on the unprotected plants were destroyed.

> "As soon as you put a *Bacillus thuringiensis* gene into a plant, you are selecting for an insect population that is resistant to *B.t.*"

The gene that protected the plants is based on a gene from *Bacillus thuringiensis* (B.t.), bacteria commonly used by organic farmers as an alternative to synthetic chemical pesticides. The B.t. bacteria produce a powerful toxin that dissolves an insect's gut on contact. Farmers using it today spray the bacteria directly on their crops. Over the past decade, Fischoff's group has isolated one of the B.t. genes, which is responsible for producing the toxin. The company's scientists have modified the gene so that the plant will produce the toxin in significant amounts. Finally, the gene has been successfully inserted into both cotton and tomatoes. The plants now produce the B.t. toxin in every root, leaf, stem and fruit.

As the field tests indicate, the results are spectacular: "The insects stop feeding almost immediately: they don't have to feed much to get a dose that will deter them and kill them," said Fischoff. "After half a decade of lab work . . . we might have something that can move on to be a potential plant product," he added proudly.

Other scientists familiar with the insect-resistant plants are not quite as excited. "As soon as you put a B.t. gene into a plant, you are selecting for an insect population that is resistant to B.t.," says James Liebman, a plant pathologist at the University of California at Berkeley.

After all, the same thing has happened with virtually every synthetic pesticide, starting with DDT — if a farmer applies a pesticide repeatedly, the local insect species develop resistance to that insecticide. In the case of these Monsanto crops, the plants will be applying the pesticide for the farmer.

"B.t. has been one of the safest pesticides around, and for a long time," says Dr. Liebman. "It has low mammalian toxicity; people think it's great. If you put a B.t. gene in the plant, and that plant expresses the B.t. gene all the time, in all parts of the plant, then you have constant selection for resistance, and you can bet that you are going to get resistant insects probably in two or three years. That would be a real shame; it would ruin B.t."

Indeed, said Fischoff at the conference, B.t.-resistant insects have already been discovered. Monsanto plans eventually to deal with the resistance problem by using several different toxins, or by having the toxin produced only in certain parts of the plant, or only during certain times during the growing season. But all of those approaches require more work — and in some cases, new scientific discovery — before they can be commercialized. In the meantime, companies like Monsanto will probably bring the products they have to market.

Another promise of the new biotechnology is developing plants that are resistant to viruses. This is big news for farmers, who today have few defenses against most viral plant diseases.

Viruses are the simplest form of life — so simple that some biologists say they are not alive at all. A virus consists of two parts: an inner core made up of genetic material (either DNA or RNA), and an outer shell, called a "coat," made of protein. A virus infects a cell by attaching its coat to the cell's membrane, then injecting its genetic material into its victim. The virus then takes over the infected cell, forcing it to make more copies of the virus. Eventually the infected cell makes so many copies of the new virus that the cell bursts, and the newly created viruses go on to infect more cells.

To make a plant resistant to a particular virus, scientists isolate the DNA inside the virus that makes the virus's coat and splice it into the plant's genetic code. For reasons that aren't completely understood, if the plant is already producing the protein for a virus's coat, that virus can't infect the plant.

Work is proceeding quickly. Tomatoes have been

engineered for resistance to tomato viruses X and Y; potatoes have been produced that won't succumb to the potato leaf-roll virus. Plants resistant to cucumber mosaic virus, tomato aspermy virus, and alfalfa mosaic virus have been developed.

Although at first there would seem nothing wrong with engineering plants for viral resistance, a recent article published by Dr. Gus de Zoeten at Michigan State University's Department of Botany and Plant Pathology has alarmed several ecologists. In the article, published in the journal *Phytopathology*, Zoeten hypothesizes that a plant rendered genetically immune to one kind of virus could be infected by another kind: inside the plant, the genes for the two viruses could mix, forming a new, hybrid virus.

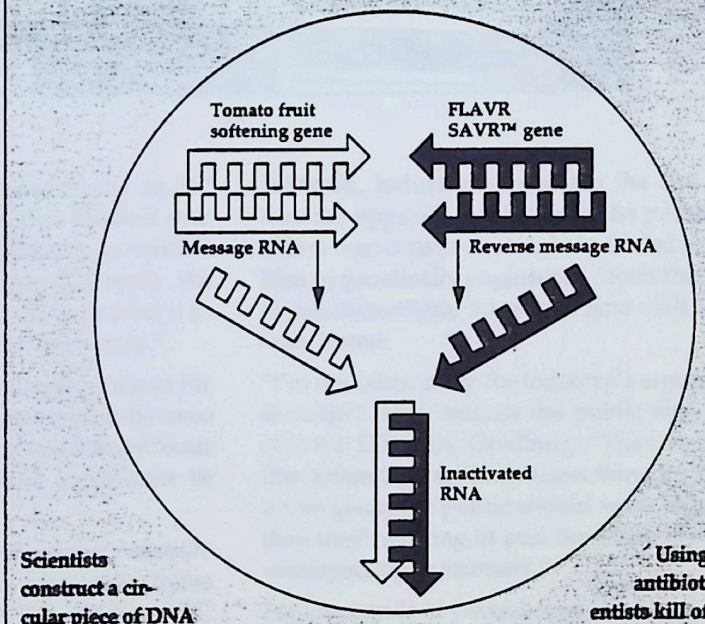
But the biggest danger of transgenic plants hasn't even been thought of yet, says Steven Witt, president of the San Francisco-based Center for Scientific Information and the author of three books on biotechnology (*WER* #51, p. 37). "If you look at any new technology, the risks that will probably come back to haunt us [are ones] nobody knows right now." Trying to understand the new world of biotechnology through eyes trained to look at chemical pesticides doesn't work. The world of genetically engineered plants has its own benefits, and dangers, that remain to be discovered.

Despite these concerns, a number of genetically engineered plants are out of the laboratory and involved in field trials. Expect them to start reaching consumers before 1995.

The new engineered varieties might create new markets. DNA Plant Technology Corp., in Cinnaminson, New Jersey, has produced genetically transformed chrysanthemums with pure white blossoms, according to a recent article in *Science* magazine. More than likely, the new chrysanthemums won't replace their colored cousins, but will be placed alongside them.

On the other hand, genetically engineered plants that are sweeter, juicier, and blemish-free might create a market climate that makes many of today's vegetables unsalable. That's a recipe for monopolies, because farmers will be only able to get each of these genetically enhanced crops from a single source. And they'll have to go back to that source every year to buy new seed: every biotech company spoken with for this article plans to sell only hybrid seed to its customers.

CALGENE'S TOMATO ALTERATION PROCESS



Scientists construct a circular piece of DNA (deoxyribonucleic acid), the basic component of all living matter and carrier of genetic information, which contains a special antibiotic-resistant gene (*kan*^{r}) and Calgene's Flavr Savr gene (antisense polygalacturonase or antisense PG).

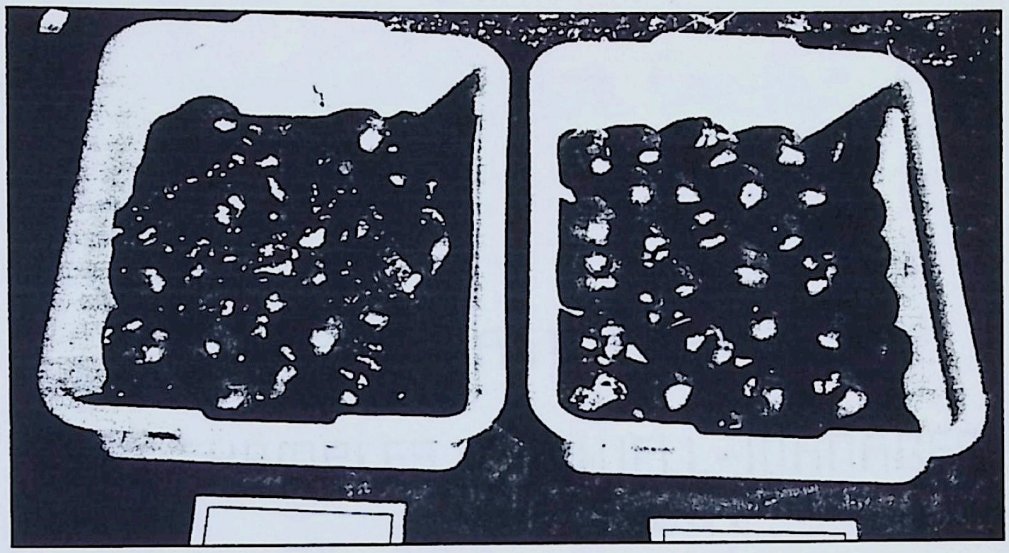
The newly constructed DNA, which now contains the two genes, is placed in special "disarmed" bacteria (Agrobacteria) capable of invading plant cells. The Agrobacteria adopt the new DNA.

The Agrobacteria containing the new genes are mixed with tomato-plant cells in a petri dish where the bacteria invade the cells, taking with them the two special genes.

Using an antibiotic, scientists kill off the plant cells that did not take up the new DNA containing the two genes. About 10 percent of the plant cells will have been successfully transformed (will have taken up the new DNA).

In separate containers, scientists prepare special growth media to enable the plant cells to produce shoots and roots, then transfer the plantlets to greenhouse pots. Selected plants proceed to tomato field trials for evaluation.

The tomatoes produced by the gene-spliced plants contain Calgene's Flavr Savr gene. Inside each tomato the gene blocks the production of the fruit-softening enzyme PG, causing the fruit to ripen normally but soften more slowly.



Twenty-five days after harvest, the tomatoes on the left are rotting. The genetically altered "Flavr Savr" tomatoes on the right are not.

"Without hybrid crops, can we make money on it?" Monsanto's Fischoff asks rhetorically. Fischoff says that it's unreasonable to think that biotech companies will want to gouge their customers: "Certainly, the goal in selling a product like this will be to price it so that there is a net positive return to the farmer."

From the public's point of view, possibly one of the most crucial problems still to be answered is the issue of labeling: should the government require that foods containing genetically manipulated ingredients be specially labeled?

"There is no reason to label it as 'transgenic,' " says Dr. Pamela Bridgen, executive director of the Association of Biotechnology Companies in Washington, DC. "Transgenic plants are around all over the place, from all the breeding that has been going on for the last 100 years."

Indeed, virtually all of the food for sale in the supermarket has been genetically altered: meat, vegetables — even the yogurt cultures. For as long as humans have farmed, agriculture has effected a steady pressure on the genetic makeup of plants and animals to mirror people's needs and desires.

"I can't imagine any reason why there should be a special labeling requirement for transgenic plants," says Dr. Kenneth Barton, vice president for research and development of Agrecetus, Inc., in Wisconsin. "I certainly think that there should be a labeling requirement for any plants that have particular hazards of some sort, [but] if it has gotten on the market, presumably they are generally recognized as safe. I just can't understand a rationale for singling out this type of breeding."

Privately, industry sources say the real reason that they are opposed to labeling is the potential for consumer fear: consumers might be scared enough by the idea of genetically engineered foods that they refuse to purchase them, no matter how well the stuff has been tested.

"I'm not taken in by the industry's argument that we shouldn't label because the public won't buy this," says the EDF's Dr. Goldburg. "They've been hyping this technology as the greatest thing for the public. If it's so great, the public should want to buy it. If not, then they're trying to pull the wool over the eyes of unsuspecting consumers."

For thousands of years, humanity has been tinkering with plant genetic material, trying to make crops that were better than those of the previous generation. Recombinant DNA technology is the most powerful technology that's come along for forcing plant genes to do our bidding: it's a tool that lets us direct the course of evolution, while making it happen on a much more rapid timescale.

Calgene's Chairman Roger Salquist has tasted the "Flavr Savr" tomato. "Am I afraid to eat them?" says Salquist. "The answer is no."

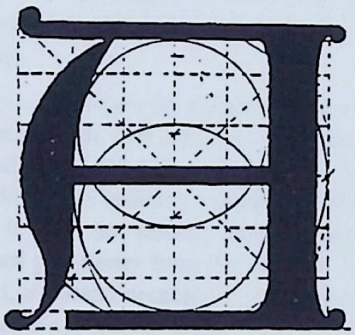
The danger is that our knowledge of plant microbiology tends to mask our ignorance of the ways that plants interact with their surrounding environment. A plant that is safe to eat might still be responsible for unanticipated ecological or economic damage elsewhere. The fruits of this new technology — intended and otherwise — may crop up in many places beyond the neighborhood supermarket. ❦

PART FIVE:

EXAMPLES OF WELL-MANAGED TECHNOLOGY

Designer as Savior, Designer as Slave

BY J. BALDWIN



S THE IMPLEMENTERS OF TECHNOLOGY, DESIGNERS HAVE a mandate to do better.

Technology doesn't just happen, it reaches society as the deliberate work of people acting as designers. Every product and procedure has been intentionally or inadvertently designed to be the way it is. It is an awesome responsibility to place in the hands of persons who are so vulnerable to corruption.

Like politicians and realtors, designers are forced by "the system" to compromise their integrity in order to function. Clients may have very different concerns and ethics than the designers they command. Worse, the clients may not be the end users. Schoolbuses, for instance, are designed to please school board purchasing-committee members. They will never set foot in the things. The result is an ergonomically despicable affront of a ride, as some of you may remember. The hapless students and the hireling driver who must endure it daily have no vote. They are not part of the design process, but they should be.

Most of the egregious waste, pollution and environmental insult caused by technology occurs because nature is left out of the design process. Designers and their masters ignorantly assume that nature has no vote. But nature always votes anyway. As has become obvious, her vote is often No.

Much social exploitation and injustice occurs when the resource requirements and unfortunate consequences of a technology darken the lives of voteless, helpless recipients who never even get to enjoy the advantages. It's called boycott or terrorism when they protest.

When the environment protests by exhibiting intolerable degradation, the principal malefactors customarily dodge responsibility. Their captive designers abdicate. The corporate system is set up (designed!) to shield designers and their masters from financial ruin if protest grows strong. Corporate clout influences politics. Things are arranged so somebody else — most often taxpayers and the poor — will foot the bill. This corruption also disrupts the apparatus of balance and redress. We and our Earth suffer. Technology is often blamed, which is perfectly logical — we are surrounded (some say engulfed) by the sorry results of many centuries of untamed technological excess. Corporations counter with the classic "guns-don't-kill-people" waffle, but it won't do any more.

Corruption also reduces incentive for the clear, comprehensive thinking necessary for good design. Look around you. Can you name even one building, out of the thousands being erected this very day, that is both delightful and energy- and materials-efficient? Can you name a product that is well designed? The latter task is a bit easier, but your candidate still represents a minority. It's probably a tool, toy, weapon, or object that would cause unacceptable functional problems if ineptly designed.

Like their designers, you probably haven't considered all aspects of your favorites. What did making the object do to the environment and to the workers who made it? What is its overall effect on individual users and on society as a whole? What will be its ultimate fate? Who will pay for the designed object? Who will pay the costs for ameliorating its societal side effects, and in what coin? Have these matters been considered under the designer's mandate, or have they

J. Baldwin started out as Whole Earth's reality tester for alternative technologies, but his expertise has spread to encompass the whole cosmology of technology, from hand tools to nuclear power plants. Here he goes to the core of technology — the mind of the designer.
—Howard Rheingold

been left to chance? Do you consider such things when spending your money?

In this discussion, I am assuming "good" designs to be those that work well in all important ways. The rare good designs that succeed in the market often achieve "classic" status. Those that don't are considered weird, and are used as textbook examples of why innovation, courage, and in particular, altruism are to be avoided. This mindless response occurs despite the fact that many studies have shown that poor sales are most often the result of faulty financial management, poor marketing technique, or bad timing.

It is more common (in all senses of the word) to consider the technology that sells best to *be* best, whether its designed applications work well or not. Profitability is usually the single, insistent, essentially political, design criterion. It does not directly demand anything more than assured popularity from the designer. Venal as this may sound, it doesn't necessarily predict inept and dangerous design. Why, then, is comprehensively good (not to mention elegant) design so rare?

This question is nothing new; things were no better in the nostalgically mourned past. Museums, history books and a few preserved or restored examples represent the best of their time. "Ninety percent of anything is mediocre," claimed mathematician Frederic Pohl, with some justification. We notice the bad effects more now because they've multiplied along with the population and its production and distribution capabilities.

Does the foregoing insist that technology is inherently and uncontrollably destructive? Must the undesirable side effects (which are integral — inadvertently designed-in) always outweigh the wonderful aspects, as many critics have suggested? Is it even possible to do better, or is the problem an intractable example of what John Barth called "basic human fuckedness"?

I think that it *is* possible to do a lot better, and that we'd best get at it soon. Hopeless, helpless abdication and acquiescence fuel irresponsibility as surely as do ignorance and malign intent. Most of us certainly feel frustrated and to some extent helpless as individuals — a state of affairs particularly maddening to young idealists anxious to put their environmental awareness to good use. The feeling of helplessness is unnecessary and inappropriate. It has three major roots, all inimical to effective individual action.

Biologic

The subtitle for this hip, sassy and wonderfully useful book is "Environmental Protection By Design." It's a rare pleasure to read it, something that I can't say for most of the zillion environmental books that have crossed the Whole Earth threshold. There's not a whiff of tiresome, guilty, faintly whiny ecoblahblah, and no quick fixes are offered. Instead, David Wann has given us, almost as a gift, a witty guide to thinking and designing our way out of the messier aspects and dangerous stupidities that sully technological society. It's a manual of good sense and successful strategies, and one of the best introductions to environmental principles I've seen. A great review/reminder book. Well designed, too. You need one.

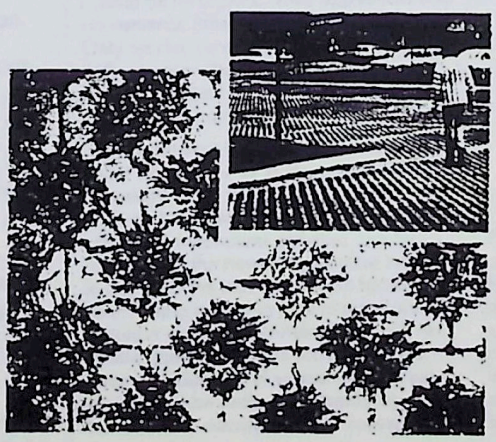
—J. Baldwin

- Ecosystems are important for two basic reasons: they are inherently valuable in and of themselves, and our technologies need to fit them. That's the crux of our environmental situation — our designs don't fit. Many of them are as unsuited for their surroundings as a loaded gun would be at our kids' birthday parties.

- Engineers tend to be problem-solvers, not problem-avoiders. If you want to get from point A to point B, they can muscle you up a superhighway, but they're not expected to give a damn about how scenic the trip will be. Their focus is on the destination, not the journey; the product, not the process. "You want to make the dog happy? No problem, we'll rig you up a mechanical tail-wagger." Ecological designers see the absurdity of such a contraption, and relate to the other end of the dog, where those brown eyes are saying, "Just let me *fit in*."

In a nutshell, conventional engineering is *logical* enough, but it's not *biological*.

Biologic
(Environmental Protection By Design)
David Wann, 1990; 284 pp.
$11.95 ($13.95 postpaid) from Johnson Publishing Co., 1880 S. 57th Court, Boulder, CO 80301 (or Whole Earth Access)



City pavements permit pollution to run off into streams and rivers, killing wildlife and contaminating drinking water supplies. "Porous pavers" allow precipitation to go into the ground where microbes can break down the chemicals. This design can also help keep a city cooler.

First is that virtually all of us, male and female, are brought up to be competitive, to win. While you might argue that team sports accent teamwork, what they mostly do is reward the unquestioning following of other people's rules, often disguised as tradition and mores. A competitor strives for black-or-white resolution. Taken to its extreme, competition excuses violence, destruction and atrocity. To view the world as friend or foe leads to paralyzing despair if the foe is seen as incomprehensible, implacable, and too diffuse to hit solidly.

The second force that engenders the feeling of individual impotence is the strongly encouraged focus on vocational specialty or "discipline," a term used to identify what's required for acceptance, license, or admission to the club (team). But a Ph.D. all too often indicates a history of ritualized obedience rather than of exploration. A kind of intellectual "monocropping" — planting all your land to one crop — is thus encouraged. As in agriculture, this unnatural concentration reduces diversity and disrupts evolution. It is also vulnerable to disruption arriving from an unexpected quarter, a common failing of all technology.

"Unexpected" implies a lack of awareness, which in turn indicates a lack of knowledge — the consequence of an incomplete education. A person trained in a discipline — an "expert" — is unlikely to have the wide view needed to integrate the expertise into a larger system, especially the ultra-complexities of ecology and environment. Training — a good word for a one-track mind — is only one aspect of a true education.

Specialization also invites oversimplification. You can be sure that a simple solution to any problem has left out something important. Beware (be-aware) whenever you hear a statement beginning with the phrase, "All we need to do is . . . ". Note also that those proposers rarely include themselves as committed actors exposed to all aspects of the project.

Because the narrow-visioned thinking of specialists is well rewarded, particularly in academia, pernicious effects are invisible to those involved. The need for interdisciplinary effort is usually considered as a theoretical matter for future discussion, impractical, or as a turf-invasion to be repelled by bureaucratic maneuver. This situation is a veritable petri dish for culturing dishonesty and ineptitude.

The third force affecting an individual's effectiveness is the intuitively sensible urge to work for security. Security can be defined as ensuring that the future will be to your personal advantage — another sort of "win." Our society condones the accompanying implication of selfishness.

Technology and Choice

These essays from past issues of ***Technology and Culture*** *dance around the central questions of controlling technology past and present. Individually, they furnish useful insight on how we got into our current situation. Taken as a whole, the selections exemplify the intricacies involved — a good thing to keep in mind when proposing countermeasures.*

—J. Baldwin

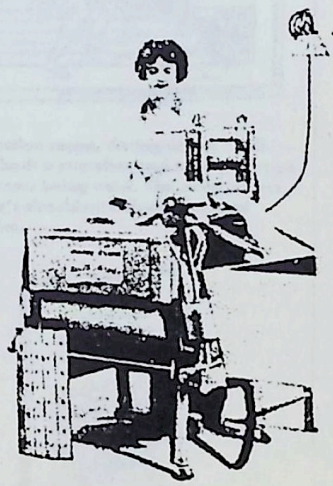
Technology and Choice
Marcel C. LaFollette and Jeffrey K. Stine, Editors. 1991; 341 pp.

$16.95 ($18.95 postpaid) from University of Chicago Press, 11030 S. Langley Ave., Chicago, IL 60628; 800/621-2736 (or Whole Earth Access)

We can now ask to what extent popular beliefs about technology and housework are true. First, there is the popular assumption that technology has made housework easier. Certainly market services have eased some elements of work, and convenience foods may also have reduced fatigue. As for utilities, we can only surmise that, while they did reduce fatigue, their secondary effects created more and new forms of housework. None of the technologies increased general pleasantness of housework, made tasks interesting, or improved the sense of self-worth of the housewife.

Second, the popular belief that technology makes housework less expensive is not well supported. The impact of utilities on cost cannot be measured, while appliances and convenience foods are more expensive. Only market services appear to be potentially cheaper than work in the home, but this is contingent on placing an economic value on the homemakers' labor.

Third is the time factor, for which popular belief would lead us to expect a decrease. However, we find that if time is saved by some technological means, the saving is offset by concomitant activities and by maintaining the new technological systems. In the past, the most significant factors contributing to saving time in meal preparation were nontechnological, such as smaller families and the increased labor-force participation of women. Now, real savings can be realized primarily by removal of this activity from the home.



Finally, popular belief has it that technology has made for less housework and thus for a redistribution of household labor among household members. However, the evidence (as opposed to anecdotes) indicates that household specialization of labor probably has not changed over time and may actually have become more burdensome to women.

"Good old New England individualism" — long considered a traditional American value — may be translated as "I've got mine, and you can go to hell." This is not systemic thinking. It is not a useful mindset for a designer who needs to realize that true security is not to be had for anyone until all people live well, in a just and ecologically sustainable society.

Security-seeking also encourages activity that is safe (proven), or that gives a safe feeling or image. There is a terrible tendency to attain a physically and psychologically secure position of some sort, and then to expend most of your energy defending it. Conserve-ative politics has its basis here. Security and its accompanying conservative stance is the exact opposite of innovation, yet innovation is clearly required if we are to extricate our society from the threatening situation now at hand.

All three phenomena examined above are rooted in the fear that there is not enough — of anything — to go around, when in fact there is plenty for all. The three working in concert (perhaps in a negative synergy) can cause otherwise intelligent people of benign intent to seek extreme positions. Frustrated people are easily deflected into zeal-

Technology and Culture

This is where people interested in technology and its effects on various cultures do battle. The tone is generally academic — not surprising in the quarterly publication of the august and slightly arcane Society for the History of Technology. Papers attend the history, development and philosophy of technology from megaview to angels-on-a-pinhead detail. There are extensive book reviews. Some dry bones here and there, but some offerings are from intrepid critics — a few with metaphorical grease on their hands — attempting to untangle the vexing questions that most investigators ignore, dismiss, politicize, or get wrong. There are gems to be found. Among them you'll encounter the frontier, which is what we came for. Good reading for techno-twits, -crats, and -phobes.

—J. Baldwin

A construction scene, dating about 1250, showing both a stretcher and a wagon-type wheelbarrow being used. The strap across the porter's shoulders reduces the load on his arms.

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When the outstanding statistical inquiry *Consumers' Incomes in the United States: Their Distribution in 1935-36* appeared, it confirmed the skewed income distribution by revealing that over two-thirds of American families received less than $1,500 per year and that most of them could barely buy necessities. Moreover, it confirmed Douglas's notion that redistributive policies would be reflationary. It outlined a number of hypothetical schemes in which income distribution in the United States was less unequal and the lower-bracket groups (whose propensity to consume was higher) were earning a larger share of the national income. In each case, a much larger amount of consumer goods would be purchased.

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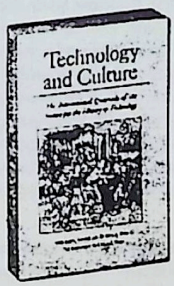
World War I caused the first energy crisis in Finland. The importation of coal slumped radically, and the supply of lamp oil (paraffin) gradually dried up. The scarcity of foodstuffs, combined with price regulation and rationing, precipitated the rise of a black market. Rumors about exhausted supplies of food and other necessities increased anxiety in the country. People were afraid that the supply of candles and matches would be depleted. The shortage of fuels and wartime inflation turned electricity into an unbeatable source of light. It did not vanish from the legal market like many other necessities because of hoarding and speculation; electricity could be generated continuously by means of indigenous energy sources (hydropower, firewood, and wood wastes). Owing to price regulation, electricity rates were not affected by the soaring inflation. As a result, in the areas that were wired, electricity became the cheapest and most reliable source of light within a few years. . . . In the so-called electrification frenzy (*sahkoistysvimma*), people neglected to consider technological expertise and economic profitability. The lack of equipment made the situation still worse. Distribution networks were sometimes built so hastily that barbed wire was used for overhead lines and bottlenecks for insulators.



Technology and Culture
Robert C. Post, Editor.

$27.50/year (4 issues; subscription includes membership in the Society for the History of Technology) from University of Chicago Press/Journals Division, P. O. Box 37005, Chicago, IL 60637

otry, but most often they give up, viewing their world with what the Japanese call "dead fish eyes."

But designers need not despair, at least not yet. They are in a better position than most to do better, even if temporarily trapped as indentured servants. There is a new breed coming into power. They are their own clients, getting on with the work that obviously must be done, as the old farts get in their last poots. The sharpest have already recognized that better security can be had by designing for a preferred future, rather than defending a structurally flawed status quo. Well-educated generalist-designers know that they always have nature as a co-client who ultimately requires a sustainable strategy.

They think systemically. They work from principle, designing *with* nature rather than opposing her, taking special care not to induce subtle "repetitive injury syndrome." They seek and take advantage of *synergy* — strategies in which the whole becomes greater than the sum of the parts. They insist upon maximum efficiency. Waste is always unprofitable, and is embarrassingly inelegant and stupid. Pollution is usually a good measure of inefficiency. It's best stopped at the source, eliminating later, more expensive cleanup problems.

The new designers also realize that corporate mistreaters of people and environment need to be won over, not destroyed. Honestly now, would you rejoice if oil companies quit making fuel? Do you really want to live without steel -- to use a stone axe? Designers must learn to employ education and negotiation skills and cooperative effort as an integral part of their practice. That's often called leadership.

If you hunger for immediate results, try initiating or joining a proof-of-concept effort, a demonstration of better ways and, of course, your skill. (Be sure it's real and not some damned simulation!) The people involved will probably include lots of students — in any case, you'll all be learning fast. You must be prepared to live in and with your work. That's a wonderful spur to clear thought, and the only way to experience the consequences of your decisions — to literally know what you are doing.*

The more patient can begin acting worldwide on what can be widely agreed upon right now, a start toward evolving *Homo technus* through the transition from the present cruel, wastrel-effete stage into one that is in tune with the requirements of a sustainable civilization. That's a big order, but people can and must take responsibility, at the very least for the hardware.

We're actually talking a critical new profession here, one that Buckminster Fuller accurately named "Comprehensive Anticipatory Design Science." It's closer to applied ecology than applied technology. It's a job for all of us. ❦

* This is what David Orr is attempting at Oberlin College (*Ecolog* p. 123): remaking the school itself into an irrefutable working example of environmental rectitude.

Nothing to Fear

The simplest technology is dangerous in some way. So is living naked on an idyllic tropical isle. How to rationally assess and manage the risks of life is the subject of this collection of often provocative papers. Profits-firsters, Earth-Firstlers and everyone in between will find plenty here to deplore, celebrate and deny hopefully. All will be made uncomfortable as their deepest beliefs are questioned. Sometimes creepy but always essential. That's about all you could ask from a book. It's the best I've seen on the subject. —*J. Baldwin*

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The United States Public Health Service also played a central role in establishing the popular imagery associated with germ theories of disease. As the uniformed avant-garde in America's fight against contagion, the Public Health Service, a branch of the military, created a literal association between the uniformed officer and the eradication of disease. In its role as hygienic gatekeeper at Ellis Island, the service further reinforced the connection between disease and immigration, and, ultimately, between immigration and crime.

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If some agencies are willing, whether by law or by policy, to spend more per life saved than other agencies, then our risk budget is misallocated. We are spending more money to save fewer lives than we could if we were less selectively cautious. Worse still, if we tried generally to achieve absolute safety or zero risk, we would probably achieve net negative effects by diverting resources away from pursuing other goods (like education or material comfort) that inadvertently improve our health and safety.

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Built into the flood insurance program is a significant section — 1362 — that involves relocation of families from persistent flood hazard areas. This, and the various provisions calling for mapping and rezoning of hazardous areas, made the National Flood Insurance Program the nation's first land use control law.

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At an earthquake preparedness meeting in Little Rock, Arkansas, in 1983, the emergency managers of the State of Kentucky and of Memphis agreed that any immediate attempt to get support for earthquake hazard zoning and retrofitting of seismic risk buildings would receive little political support; they worried that if such an effort were begun at that time, the whole cause of earthquake preparedness in the Mississippi Valley would be actually set back. But they agreed that they could start raising a new generation of voters who would be knowledgeable about earthquake risks and who would eventually pressure their representatives to do what needs to be done.

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Unlike disaster research and natural hazard research — both of which inform the work of public bodies, but are mainly carried on by academics — risk analysis practices are being systematically adopted by bureaucratic organizations. Several factors have combined to encourage its use as a procedure in public decision-making. Inquiries into spectacular disasters have turned up evidence of inadequate consideration of risks in existing technological